THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVIII. No. 1749.] LONDON, NOVEMBER 17, 1896. [48TH YEAR. PRICE 6d.

TUBES AND FITTINGS
FOR
GAS, STEAM, WATER,
AND ALL PURPOSES,
ALSO
COILS OF EVERY SIZE AND SHAPE.

Apply to the Original Firm of
JOHN BROTHERTON
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Imperial Tube Works, Monmore Green,
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ESTABLISHED 1861.

Lanemark Coal Co.,
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LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on Application to
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Shipping Ports: All the principal Scotch Ports.

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Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.
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Prices and Analysis of all the Scotch Cannels on Application.

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FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
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MANY HUNDREDS WORKING AT GAS-WORKS.
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MELDRUM BROS., ATLANTIC WORKS, MANCHESTER.
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Wrought-Iron Roofs, Bridges, Girders, &c.,

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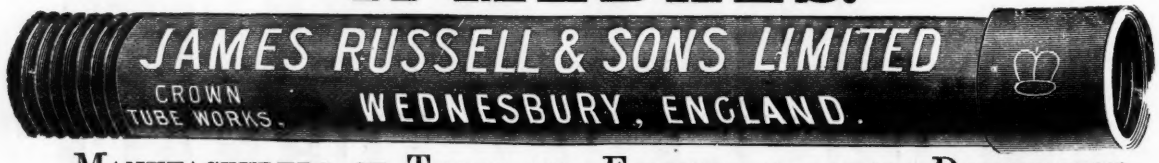

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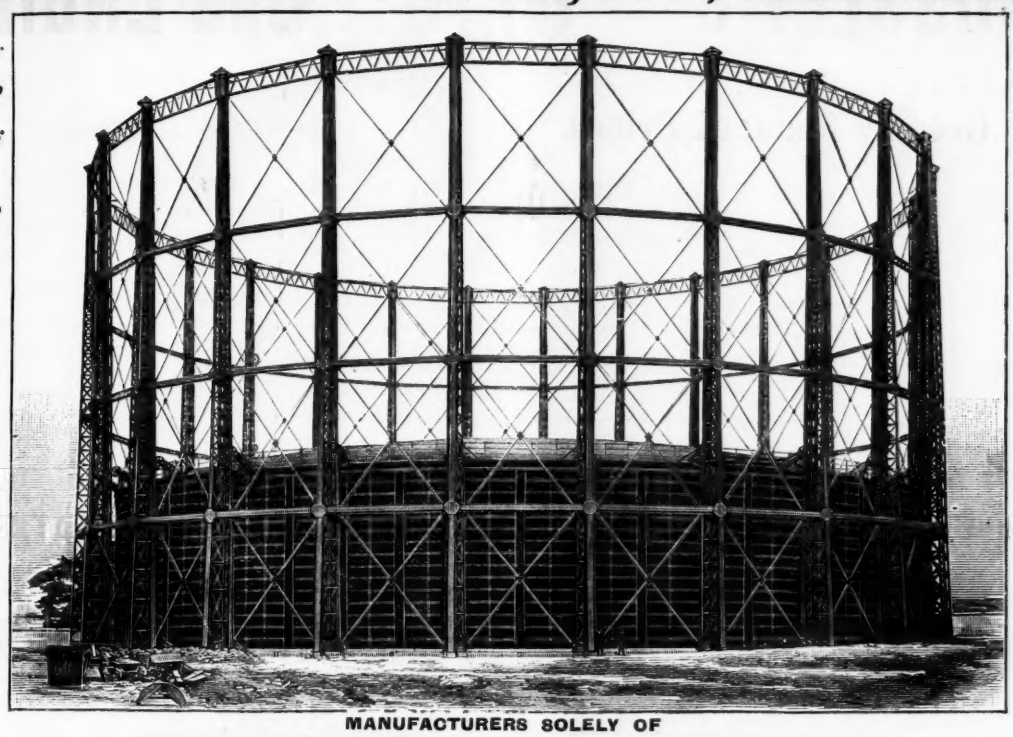

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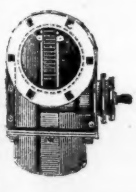

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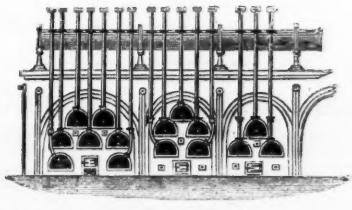

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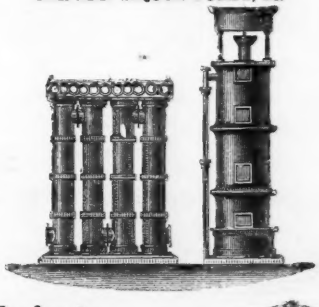

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for working Purifiers,

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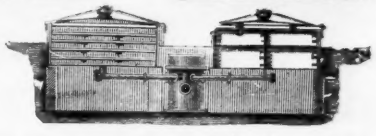

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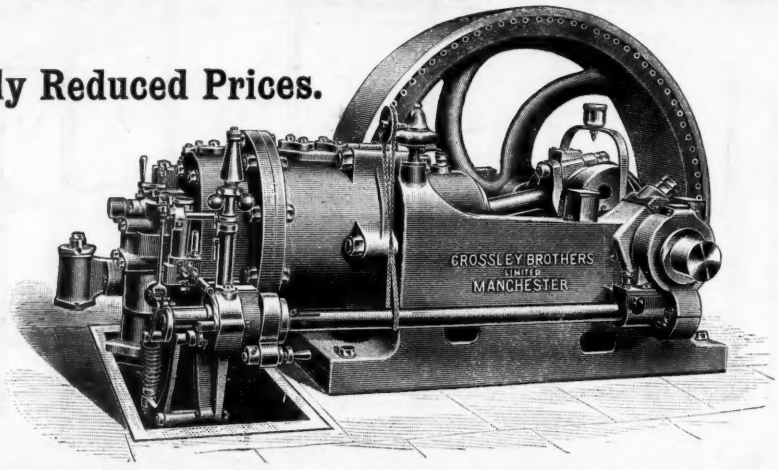

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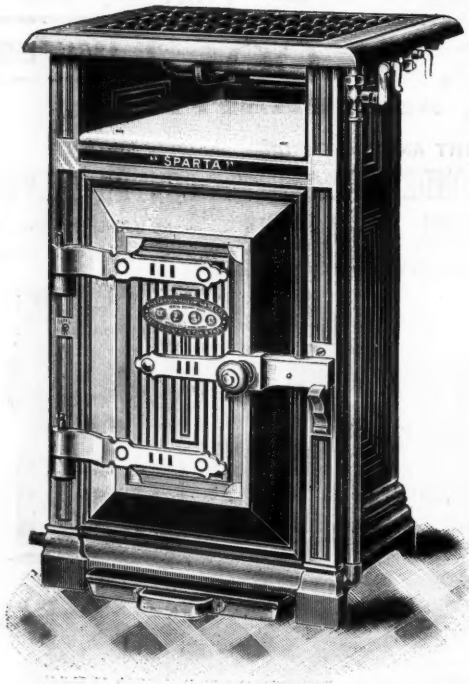

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Outside Dimensions: 30 in. high, 19½ in. wide, 15½ in. deep.

Two Boiling-Burners on Hot-Plate.

LIST PRICE, **£2 7s. 6d.**

With Enamelled Crown-Plate extra.

ALL GAS ENGINEERS SHOULD SEE THIS COOKER BEFORE ORDERING ANY OTHER.

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INCANDESCENT GAS-LIGHT

(WELSBACH PATENTS).

Important Notice.

Large Reduction in Prices From March 2, 1896, Due to Colossal Sales, And Universal Adoption of the System.

THE GREATLY REDUCED CONSUMPTION OF GAS
Covers the Initial Cost of the Burners in less than SIX Months.

The Prices have been REDUCED as follows:—

The Ordinary "C" Burner, price 6/6
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Prices of other Patterns Reduced Proportionately.

Special attention is called to

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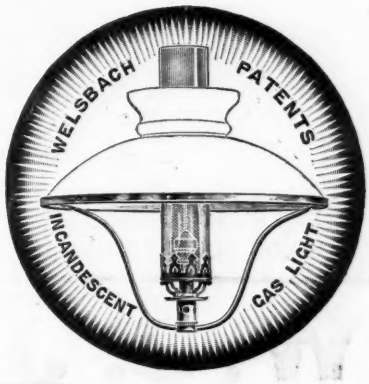
which, with a consumption of 2¼ cubic feet of gas an hour, gives

A LIGHT OF 25 TO 30 CANDLE POWER.

This pattern is particularly recommended where it is desired to effect a large saving in gas rather than to effect a great increase in the light.



The attention of Gas Managers and Gas Engineers is called to this System of Lighting as one which tends to Popularize the Use of Gas as an Illuminant, owing to the following Advantages:—

Economy in Consumption of Gas, combined with High Illuminating Efficiency.
Freedom from Smoke, Dirt, and Flickering.
Greatly Reduced Heat.
The combination of High Lighting Power with DURABILITY can only be obtained by The Welsbach System.

The "Lancet" Special Analytical and Sanitary Commission, in an exhaustive report, pronounces the "Incandescent Gas-Light System" to be the Healthiest, Best, and most Economical System of Gas Lighting.

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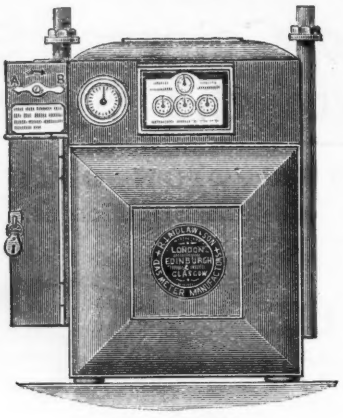
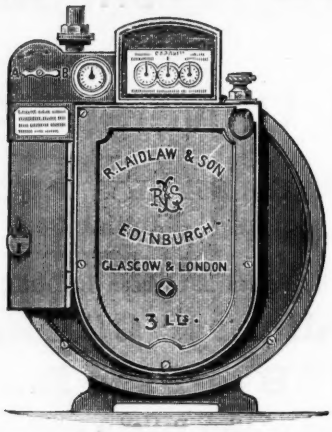


—DRY METER.—



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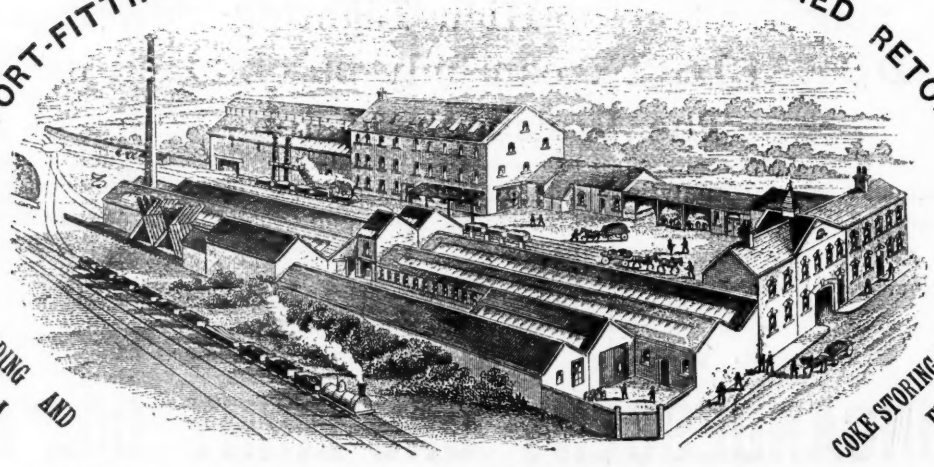

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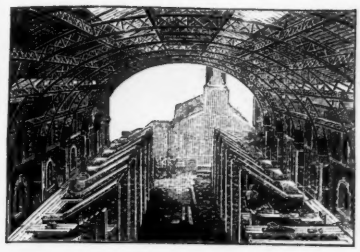

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PATENT SCRUBBER-WASHERS,
All sizes,
From 50,000 to 5,000,000 Cubic Feet of Gas per day.
Results unrivalled. Send for Particulars and Prices.

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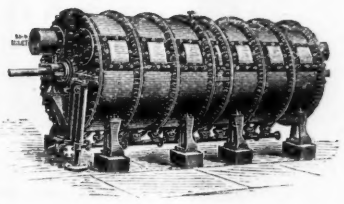

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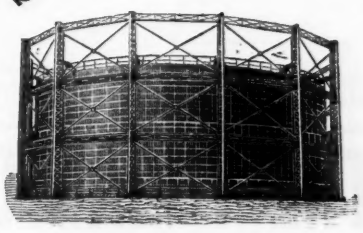

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Rotary or Pump
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GENERATOR & REGENERATOR FURNACES & SETTINGS

GIVING VERY BEST RESULTS.

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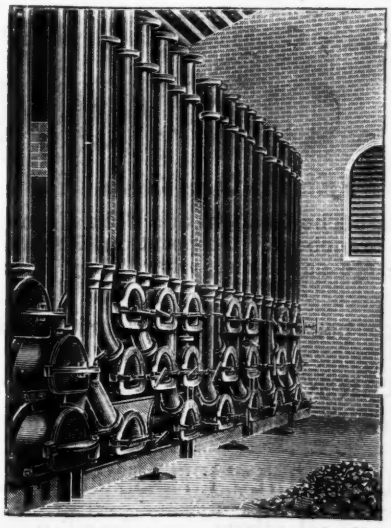
This COMPANY write—

"Mr. Chester's Furnaces and Settings you have erected for us work exceedingly well. Splendid heats under easy control. Nearly **50** per cent. less Coke used for Fuel than formerly. Very convenient for Sunday stopping. Work done in a thorough manner, to our entire satisfaction."



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Mr. LISTER writes that—

"The result of using Chester's Furnace and Setting for first Six Months of 1896 was to produce 26,000 cubic feet more gas, using 35 tons less coal, and having 171 tons more coke for sale, compared with same period of 1895."

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"Can make 8000 to 9000 per mouthpiece easily with **Mr. Chester's Regenerators** you have erected for us. Fuel Consumption much less than with our Generators. Heating of Retorts very even. Very well pleased with working. Results exceed expectations."

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MARSHALL'S PATENT COMBINED BATTERY CONDENSER AND SCRUBBER.

Extract from letter from Mr. Winstanley, of Coventry: 'The Condensers you erected for us have been in use some time, and are working very satisfactorily.'

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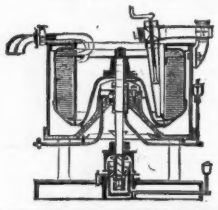

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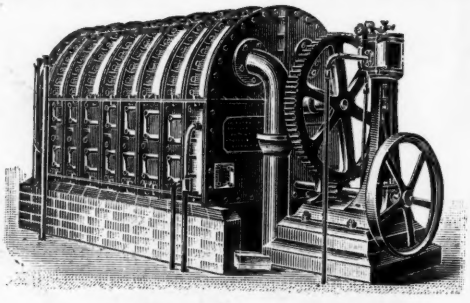
PATENT "STANDARD" WASHER-SCRUBBER.



OVER 530 MACHINES

In use and in course of Construction.

They extract all the Ammonia and a large proportion of Carbonic Acid and Sulphuretted Hydrogen.

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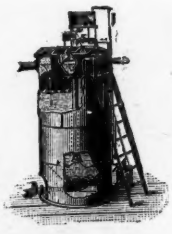

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Extract from letter from the Late Mr. Jabez Church: "The Marshall Patent Tar-Extractor has given very satisfactory results."

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FOR ENRICHING GAS IN BULK.

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CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **FOUR YEARS.**

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital, Labour, Fuel, Wear and Tear, &c.

The Enrichment is INSTANTANEOUS and PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

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"THE ERA."

(Registered.)

A New Fire, with Circular Front, for this Season.

Has a perfect arrangement to utilize all Products of Combustion.

SPECIALLY MADE FOR HIRING-OUT PURPOSES.

No.	Height. Inches.	Width. Inches.	Width of Fire. Inches.	Price, Best Stove Enamel.
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1082	30½	22½	10	**60s.**
1084	31½	25½	13	**70s.**

NOTE.—Prices include New Duplex Burner, Two Brass Lever Taps, and Fittings all complete, which can be had either right or left hand.

NICKEL PLATED TRIVETS . . . . . **2s.** EXTRA.

Sole Makers of the celebrated "ACME" GAS COOKERS used by H.R.H. the Duke of York, CARVING-TABLES, HOT CLOSETS, and JAPANNING OVENS, &c.

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MANUFACTURERS OF

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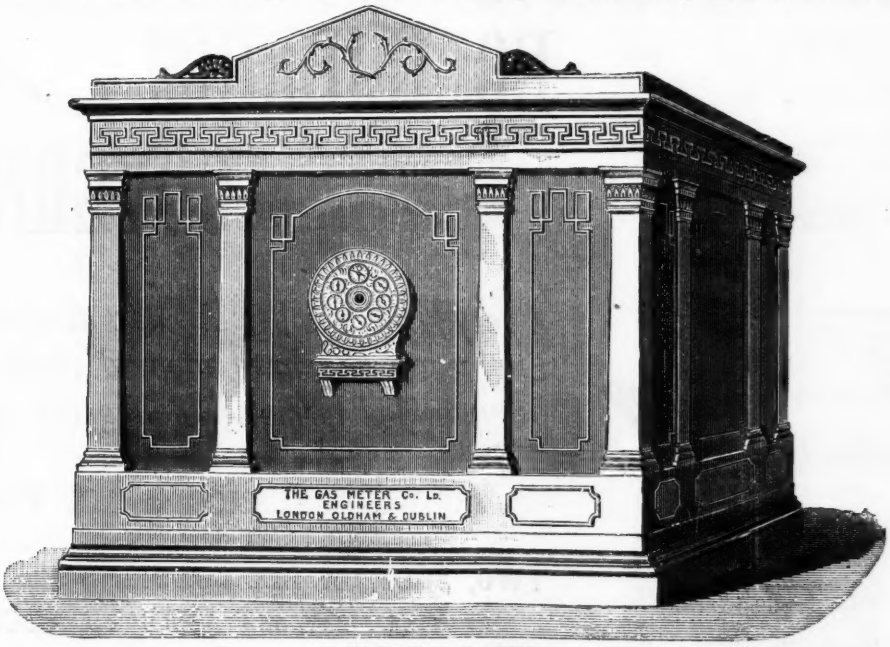
SQUARE STATION METERS WITH PLANED JOINTS.



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DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, LATE WEST & GREGSON. Established 1830.

For Prices and Particulars apply to

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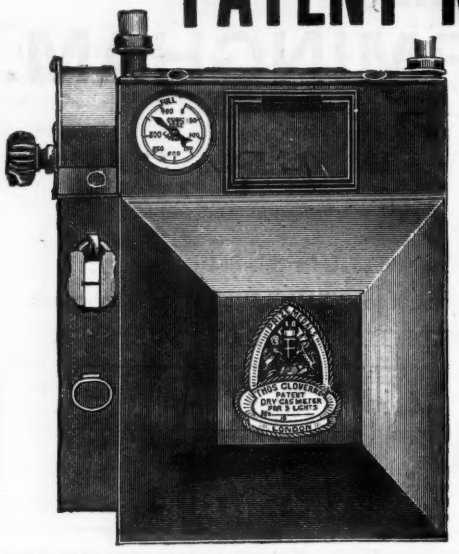

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EDITORIAL NOTES.

The Meeting of the Southern District Association of Gas Managers.

THE first meeting of the United Southern and South-Western Gas Managers' Association was held last Thursday, at the Southern head-quarters, and was fairly well attended; some of the prominent members of the absorbed organization being present to show goodwill towards the enlarged society. Nothing could have been better, indeed, in temper or taste, than the expressions of mutual regard between the old and new members of the Association evoked by the formal announcement to the meeting that the amalgamation was now an accomplished fact. Both numerically and in respect of the area of country represented, the Southern is now the largest British Gas Managers' Association; and the late Honorary Secretary, now the President, of the Association—Mr. J. W. Helps, of Croydon—expressed what must be the prevailing sentiment of the members when he declared that this strength ought to be the source and sustenance of a vigorous and beneficent future life for the organization. No District Gas Managers' Association has a better record than the original Southern; and it should not be too much to expect that its usefulness will be increased to keep pace with the extension of its sphere of influence.

Happily, the proceedings on Thursday were of a very satisfactory and reassuring quality. Two papers were read and discussed; and both were of a high order of interest and utility. Mr. W. E. Price, of Hampton Wick, performed a valuable service to the gas industry of the United Kingdom by preparing a paper which, with the laboriously-compiled tables and diagrams that accompanied and illustrated it, gave a bird's-eye view of the course of the residuals markets over several years. The state of the market for sulphate of ammonia is justly a source of perplexity, and even anxiety, to most gas managers, constrained as they are to cut the price of gas as fine as working expenses and results permit; and it is distinctly useful to have the facts displayed in a fashion that he who runs may read. Mr. Price has, by his graphic method, made it clear that the prime cause of the weakness of the sulphate market is the falling off in demand both for export and home consumption, and the consequent accumulation of stocks. The deplorable consequences that have followed upon the adoption, by the largest makers, of the blundering policy of stocking this product, are familiar enough; but Mr. Price enables it to be seen how hopeless the policy was from the first, as a device for checking the depreciation that had already set in. Values began to fall with the failing demand. If production could have been suspended for a short time, the rate of depreciation might have been modified; whereas what was done merely aggravated the mischief. Mr. Price shows that, as regards home consumption, all the attempts that have been made to get sulphate better appreciated by the British agricultural interests have not availed to improve matters in this regard since 1885; and this is the saddest part of his cheerless story. In the course of the discussion on the paper, Mr. Frank Livesey stated that there is reason to believe that sulphate is taking a turn for the better; and it is to be hoped he is correct in his judgment.

Mr. Randall's paper on regenerative retort-settings for small works is a welcome contribution to the contemporary literature of a subject not so much written about now as it was some years ago. It is always desirable that the progress of a special branch of technics should be duly reported from time to time; and Mr. Randall's paper is a model of candour in treatment as well as a valuable record of the accomplishment of something not far removed from the highest level of carbonizing efficiency. Writing off-hand, and without being able to verify the reflection, we even venture to question whether any results quite so good as those reported by Mr. Randall have ever been published before. Certainly, they are far beyond anything that the ordinary accounts of gas undertakings show as constituting the standard of carbonizing practice; and if they could be realized on the large scale of a Metropolitan or a Provincial gas-works of the first magnitude, the manager who should so approve himself master of his trade would deserve a salary more nearly approaching the earnings of a popular music-hall artist than the wretched pittance

usually doled out to gentlemen in his position. Mr. Randall has been very careful in the framing of his paper; and he is to be congratulated on the completeness with which he has realized the ideals of the pioneers of gaseous firing. If he can only keep up the pace of progress, he will certainly go far.

In concluding this notice of the meeting, we cannot refrain from offering an extra meed of congratulation to Mr. Helps on his selection for the office of first President of the greater Southern Association. The members honour themselves in thus recognizing the merit of one of the best and most popular of Honorary Secretaries of the technical societies of the kingdom. Mr. Helps has worked for the Southern District Association with a devotion to duty and resourcefulness that are beyond praise; and he has done this through difficulties and under conditions of stress not easy for even his most intimate friends to apprehend. It is but right that such workers should receive, as Mr. Helps now does, assurance of the esteem in which they are held by their fellows.

Street Subways.

A WRITER in last Saturday's "Daily Graphic" dealt very engagingly with the subject of street subways for gas and water mains, with particular reference to the proposal of the London County Council, mentioned in last week's "JOURNAL," and the counter-proposal laid before this authority by Mr. Walter Emden. This is a matter, as our contemporary sagely observes, that belongs to the order of topics which are regularly agitated in the newspapers at seasonal intervals. The present is not the most favourable season for a subways agitation. "During November, "the popular voice, if raised at all, is raised to ask why "some means cannot be devised for preventing fogs, just "as in summer it asks awkward questions about the water "supply, and in the frozen deep of winter makes suggestive "remarks about the future of water companies. The time "of year in which to talk about subways is just past; its "apogee is during October, when all the streets are 'up,' "and London is an *inferno* of navvies for disturbing the "roads, and smoking cauldrons of pitch to provide "materials for laying them again. Then the Londoner "begins to ask why he cannot be saved all this incon-"venience, and why all the gas-pipes, and all the water-"mains, and the pneumatic tubes and telephone wires "cannot be put in a tunnel underground, where they could "be repaired without congesting the traffic." This is a very fair rendering of the way in which "public opinion" moves in respect of the matters in question. It is one of the responsibilities of local authorities, statutory supply and transport companies, and municipal engineers to deal with such matters before they arrive at the state when "the man in the street" begins to write to the newspapers about them; and this question of street subways has not been wholly neglected by those whose interest in it is of another kind than that of making interesting newspaper "copy" about it.

So far as gas supply is concerned, it is not exactly true that subways for gas-mains, especially as designed by amateurs of municipal engineering, would necessarily be of so much advantage to the service that the undertakings would be justified in paying for their construction. It should be only necessary to remind those who entertain this opinion of the circumstances attending the recent introduction of underground electricity distribution conduits, which are subways of a kind, to cause them to perceive that the problem is not quite so easy of proper solution as it looks to those who are not conversant with all the elements that enter into it. The London County Council thought they could settle the matter off-hand in 1890; but they found out their mistake. Last January, the Council took up the question again on the instigation of Mr. Emden, and referred it to a Committee to consider and report on the expediency of application being made to Parliament for powers for the Council and the local authorities to construct subways under streets. The Committee deliberated on the reference, and came to the conclusion that it should be discharged, having regard to the experience of 1890. This pusillanimous policy did not please Mr. Emden, who has come forward with a noble scheme to show how the making of commodious subways could be combined with an extensive system of cellars, which is duly illustrated and described in the "Daily Graphic." It is admitted that this plan would cost a trifle of about £100,000 a mile to carry out; but there is to be "recoupment" in the shape of pipe and cellar rents, which are estimated to produce exactly £3942 a mile per annum.

It is not to be wondered at that even the precision of these figures failed to convince the Highways Committee of the London County Council that the adoption of a scheme of such magnitude is expedient. Mr. Emden has been too ambitious. There is no necessary connection between pipe and cable subways, a big central tunnel under the roadway to relieve traffic, and a system of cellars. Any one of these constructions may be desirable; but there is no reason for lumping them all together and making one help pay for the rest. Moreover, in all crowded city thoroughfares, the practice now is to run distributing plant which may require to be got at occasionally under the side footways; and these would lie outside any big central subway. There might be something said for the plan lately suggested by the "Engineer," and duly mentioned in these columns at the time, for making a continuous covered trench under the sidewalk, to contain the district mains and wires; but here again the real question is as to the degree of utility of such a construction. At any rate, London is not neces sarily the place for trying an experiment of the kind, which could be better done in Manchester, Glasgow, or Liverpool, where there are fewer conflicting interests in the highways. An interesting paper on the whole subject might be written for a Gas Managers' Association by any competent engineer who would take the trouble to look into the question of subways and sidewalk trenches in relation to the supply of gas. There is a special practice in gas distribution for crowded thoroughfares, which necessarily differs from that which is applicable to the simpler requirements of small towns and suburban roads; and the bearings of this practice on the subway question have never been collected in the form of a technical paper. We offer the suggestion to whomsoever it may concern, and hope it may bear fruit in due season. There is quite a history concerning gas distribution in the streets of London, dating from the competition era; and the victory of the Gas Companies in the matter of obtaining permission to do their own paving work was not the least important stage of their economical development.

Motors and Tramcars.

LAST Saturday was "Motor Day," the new law and regulations opening the public highways to mechanically-driven carriages then coming into force in England and Wales. In London and elsewhere, extensive preparations had been made for signalizing the commencement of the new era, and processions of auto-motor cars were the order of the day. The Local Government Board have issued an elaborate set of instructions to County Councils and other local authorities defining the character and method of using what is termed "the light locomotive" which it is now lawful to drive on common roads. This expression means a vehicle, propelled by mechanical power, which is under three tons in weight unladen, and is not used for the purpose of drawing more than one vehicle, and is so constructed that no smoke or visible vapour is emitted therefrom except from some temporary or accidental cause. The last-named restriction practically shuts out steam cars for the present, and puts the problem of effective condensation in the very forefront of those peculiar to this kind of motor. With a view to the probable use of oil-motors for these light locomotives, the Home Secretary has rightly seized the occasion for cautioning the public in respect to the nature and properties of the so-called "oil" which it has been found most convenient to use for this purpose. It is not oil at all, but petroleum spirit, with which the public are better acquainted under the name of benzoline. Consequently, those who may have anything to do with the stoking, driving, or housing of these cars will have to be careful what they are about. If such contrivances are to come into anything like general use, it follows that there will be many more dealings with benzoline, and in much larger quantities, than hitherto. It will certainly not be safe to store these carriages in working order in a coach-house or stable-yard, where other vehicles and men with lanterns are to be met with. What is to be done with them if they finish a day's run from home after dark is therefore likely to be a query of some interest to others besides their owners. The very fact that these conveyances are mere toys at the present time rather enhances the danger of them than allays it; for if a well-designed

benzoline motor in experienced hands is an element of danger, much more will this be the case with an imperfect machine and an inexperienced attendant.

It may be said that this is taking a very unfavourable view of the prospects of mechanical road traction; for if steam is a nuisance and benzoline a danger, what kind of mechanical power remains? We admit the impeachment, and remain of the opinion that has already been expressed in these columns, that mechanical propulsion is not yet sufficiently advanced for general application to road carriages. If the relaxation of the law will assist the development of mechanical traction for common roads, well and good. A great deal of development will be necessary, however, before the system will be good for anything more than the amusement of a few wealthy amateurs of mechanics. We take this opportunity of extending a welcome to the enterprise of Mr. W. H. Dunkley, of Birmingham, who is reported to have actually in hand the construction of the first horseless vehicle for common roads—an omnibus intended for use in the city—to be driven by coal gas. The store of fuel is carried in compression cylinders placed underneath the seats; and the working of the experimental light vehicle is stated to have proved that a carriage for two people can be run for sixty miles at a cost of 2s. 6d. for gas.

The first problem to be solved in this connection, as we have repeatedly urged, is that of tramway working. Until tramcars can be satisfactorily driven by mechanical power, it is absurd to claim that the solution of the far more difficult problem of independently-moving road-carriage propulsion is in sight. It is only necessary to turn to the report of the discussion on the former question at the last meeting of the Belfast Corporation to see how this matter stands. The Corporation in question have been looking everywhere for a mechanical power system of tramway working, and have been driven at last to adopt a report favouring electric traction, but judiciously leaving the precise form of its embodiment an open question. It is a fortunate coincidence that the first ordinary (statutory) general meeting of the British Gas Traction Company has just been held; and the opportunity was then taken by the Chairman, Lieut.-Col. W. T. Ellis, for delivering a most temperately-worded address setting forth the claims of gas power as the most promising agent yet discovered for superseding the horse in tramway working. The Chairman is not afraid of the overhead electric traction system, which, as he observes, has been swept out of Washington, is prohibited in New York, and is condemned to be cleared out of Boston within two years. This is something for Belfast to take note of; for it would be a little too ridiculous for a leading Irish city to take up with the cast-off device of the United States. Lieut.-Col. Ellis showed succinctly why the gas-power car has the best possible prospects of at least an experimental success. One or more of such cars can be put upon any line at small cost, and tried in and out with the horse cars; whereas an enormous capital expenditure must be faced before a single cable or electric car can be put in service. He had naturally not very much that was novel to say of the working of the system beyond stating that after fourteen weeks' experience at Blackpool the cost of running one of the Company's 42-passenger cars was found to be 4½d. per mile. It is this Blackpool demonstration which will settle for the time being the prospects of gas-power tramcars in the United Kingdom.

Fuel Gas and Incandescent Gas Lighting.

A BRIEF but pregnant epistle has been addressed to the Editor of "Engineering" by Mr. J. L. Dexter, who writes from High Wycombe, drawing attention to the possibility of adapting incandescent gas-burners to a fuel-gas supply. He states that a millowner who had a Dowson gas plant was advised by him to try incandescent gas-burners for obtaining light from this gas, and did so with success and at a cost for gas of less than 3d. per 1000 cubic feet. It would be a satisfaction to have further particulars of this interesting application of the incandescent burner to fuel gas; because, if the result is really good—and there is no reason to the contrary—we have here opened up a vista to which there is no horizon. Curiously enough, not one of the writers who have discussed of late years the prospects of fuel gas has hit upon the idea of making it in this way a source of light as well as of power; and until we saw Mr. Dexter's letter in our contemporary, we had no knowledge of the experiment having been tried. Here is a knock-down for high-power gas, with a vengeance! The matter is well worth the attention of gas engineers and power users; and the new use thus found for semi-water gas is well calculated to impart a fillip of interest to this well-worn subject of technical inquiry. The possibility of getting a light from it by the assistance of the incandescent burner will not, of course, make fuel gas of greater industrial value than it was before this discovery. It must remain as unsuitable as ever for distribution to any considerable distance. But it is quite possible that the prospect of being able to get a good light from it at a cheap rate may turn the scale in favour of fuel gas with many millowners who have hitherto confined themselves to the use of steam power. At any rate, Mr. Dexter's hint is "another nail in the coffin" of the incandescent electric lamp for factory use.

WATER AND SANITARY AFFAIRS.

THE London County Council, at their meeting on Tuesday last, resolved to make one more effort to obtain possession of the London Water Supply. But it is a forlorn hope, involving a fresh application to Parliament for powers of purchase. It is decided that "a Bill or Bills" shall be promoted in the ensuing session, whereby the Council shall be empowered to acquire the undertakings of the Metropolitan Water Companies, either by agreement, or compulsorily on arbitration terms; the Council, acting in conjunction with the Corporation of the City, to be the authority for supplying water within the area of the county. The Progressive party have made every effort to gain the support of the Moderates in pursuance of this design, but in vain. As we stated last week, the aid rendered by the Earl of Onslow to carry out a compromise between the two parties on the water question proved ineffectual. The Parliamentary Committee tried their utmost to secure a union of forces; but failing to obtain the adhesion of the Moderate party to the "heads of agree-" ment" which had been settled by the Sub-Committee, they proceeded to make other recommendations to the Council. The main difference was described by Mr. Beachcroft as consisting in the question of what authority should administer the undertakings after purchase. Lord Onslow, in his speech to the Council, said it was admitted on all hands that a Bill for the acquisition of the water undertakings should be introduced; but he contended that, with regard to the authority which should administer the water supply, the Committee laid down a plan totally opposed to anything Parliament had ever sanctioned. The proposal was that the Council should supply the county, and that the outside authorities should have power over the water in their own districts. But Parliament had always declared that the Metropolitan water area should remain one. His Lordship told the Council they knew well that the House of Commons would refuse to entrust them with the administration of the water supply, and yet they proposed to waste the money of the ratepayers in the promotion of yet another Bill "harassing and attacking the Water "Companies." The amendment moved by Lord Onslow in connection with his speech, differed from that of which he had given notice. It included a considerable portion of the compromise, but retained proposals quite at variance with the Progressive plan. It was of course rejected. The Hon. Lionel Holland subsequently moved a further amendment, proposing the adoption of the compromise. Another attempt was then made to win support from the Moderates; the Progressives—as represented by Mr. M'Kinnon Wood—offering to stand by the compromise if a majority of the Moderates would do the same. This was the last chance for a combined movement; but Lord Onslow effectually destroyed it by saying that, if he voted for the compromise in the Council, he should reserve the right to oppose the Bill in Parliament. The compromise thus went to the winds, and the recommendations of the Committee were thereupon adopted.

The certainty that the County Council Bill will fail in Parliament is founded not only on the character of the measure as settled last Tuesday, but on the circumstance that the Council are divided on the question. "Unless

"the compromise can be revived," says "London," "we "may gain some party advantages over the Moderates, but "we can make no progress next year with the water "problem." Whatever may happen in the future, it is perfectly evident that, as matters stand, the Moderates are clear of the Water "Bill or Bills" of the County Council. When the recommendations of the Parliamentary Committee were put to the vote, Lord Onslow and several of the leading members of the Moderate party left the Chamber. Against the proposals of his Lordship it was urged that they would cause another body to be created, to which would be handed over the whole power of purchasing by agreement the undertakings of the Water Companies. Mr. Stuart, who employs this argument, must give due weight to the probability that the Council will not be entrusted with the administration of the water supply, and therefore is not likely to be concerned in settling the terms of purchase. The Council, as represented by the Progressives, look upon themselves as essential to the settlement of the water question; whereas they are singularly ill-adapted for the purpose, and have shown themselves by no means qualified to exercise the necessary powers. They are "out of court" in the matter; but they fail to know it. Moreover, there is a previous question, to which "The Times" very properly calls attention, and that is whether it is necessary or expedient for the water-consuming ratepayers to purchase the undertakings of the Water Companies "at all." Sir John Lubbock, in a long and exceedingly able letter to the leading journal, reiterates and emphasizes his objections to municipalizing the water supply, and points out the financial and other disadvantages under which London would be placed if the County Council were allowed to supersede the Companies. A letter followed from the Hon. Lionel Holland, taking the opposite view.

"The Times" has again rendered good service in disseminating correct views on the subject of the Metropolitan Water Supply. In the course of last week, an article appeared in its columns on "The Purity of London "Water," in which the proportion of suspended matter in the supply was shown to be so infinitesimal as to justify the Companies' Chemists in the use of the word "none." The term is, of course, to be taken relatively; and its use in this instance is justified on practical grounds. Chemically there is gold in the sea, while commercially there is "none." The point has been well put in the "British "Review," from which a quotation appeared in our columns last week. At the very worst, 25 gallons of water are requisite to produce a single grain of the suspended matter; and, on an average, the grain has to be sought in an aggregate of nearly 500 gallons. There is, however, a very general oversight as to the point at which Mr. Dibdin aims, and to which we drew attention in our issue for July 7—namely, that the matters in suspension would be wholly got rid of if the Companies would go to the expense of softening the supply by means of Clark's lime process. Whether it is worth while to spend so much to gain so little, is another question. Still, the mere softening of the water would be a great recommendation; and there is no reason to suppose that the London water, so treated, would be rendered in any degree dangerous to health by contact with leaden pipes. The value of the suggestion consists in the fact that it renders the proposed Welsh supply entirely unnecessary on the score of purity. But the consideration is a remote one; and there is nothing to show that the present supply is open to any reasonable objection. It is good and pure, so as to meet every sanitary requirement. Respecting the swarms of bacteria reported by Dr. Klein, "The Times" dwells on their strange variations, the discrepancy between the number enumerated by Dr. Klein and Mr. Dibdin, and the want of any correspondence between the degree of filtration indicated by the quantity of suspended matter and the number of microbes observed. Dr. Klein replies to the strictures of "The Times," and seeks to justify taking samples by the quart at public stand-pipes, instead of testing the water as it leaves the filter-beds. The case must be described as one in which ultra-scientific views are at variance with common sense and the practical purposes of life. From Mr. Crookes and Professor Dewar there proceeds, in their last monthly report, a brief but able vindication, given in another part of our columns, of the mode by which they have tested the water supply on behalf of the Companies.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 982.)

THERE was a decided lull in the Stock Exchange last week after its active and excited predecessor; and things quieted down considerably. But it is worth noting that there was nothing at all like a reaction succeeding to the previous extreme buoyancy of prices; and this is a favourable sign. Markets on the whole may be written fairly steady; and variations in value generally are but slight. Dealers complain that the public are holding themselves very much aloof; and, indeed, there seems to be a wide disposition to wait a bit until one or two financial problems develop themselves. A dominant feature was the extreme strength of the Money Market; and on Thursday it was thought at one time that we were in for a 5 per cent. rate. This fear naturally helped to keep people quieter still. Business in the Gas Market continued very brisk and plentiful; the level of activity developed in the preceding week being fully maintained. As then, so in this week also, the two big issues were conspicuously in front as regards both activity and strength. Several variations in quotation were effected, and most of them were considerable in degree; and, with few exceptions, they were all in favour of enhanced prices. In Gaslights, the "A" was very brisk and buoyant, opening at the previous Saturday's figure of 313½, and running very steadily up to a closing mark of 321. The secured issues were very little dealt in, and afforded nothing to call for remark. A good bit was done in South Metropolitan at very steady figures; the price sticking on tight to 147. There was rather more done in Commercials; and for some reason or other, the quotation of the old stock was put down a little. Sometimes holders may be scared into selling at a lower price when they could not be persuaded into selling at a high one. The Suburbans and Provincials were even sleepier than usual—hardly a bargain being done all the week; and the only move was a further smart rise in Tottenham. In the Continental group, Imperial was, of course, the centre of attention; and it steadily advanced its recovery—rising from 227 *cum div.* on Monday to 226 *ex div.* on Saturday. Union and European were strong and steady. Among the rest were some movements of importance. Australians were in bad odour; and both Sydney and Melbourne went back—local influences being depressing. Argentines were stronger; and Orientals had a further rise on the report and accounts coming out. Business in Water was perhaps a shade more extensive; but it amounted to very little then. However, the tendency was more favourable; and quotations pointed upward.

The daily operations were: Business in Gas was active on Monday, mostly in Gaslight "A" and Imperial. The latter rose 3; Tottenham, 5; and Belgrano, ¼. Less was done on Tuesday; but South Metropolitan had the bulk of it. Gaslight "A" rose 4; and Tuscan debenture, 1; but Commercial old fell 1. In Water, East London and Lambeth gained 2; and ditto debenture, 1. Wednesday maintained the rate of activity; and prices were good. But Sydney fell 2; and San Paulo, ½. Lambeth Water rose 2 more. Thursday was a shade quieter, but firm. Gaslight "A" and Imperial advanced 1; and Sydney, ½. But Commercial old dropped 2. On Friday business was brisker; and Gaslight "A" and Imperial improved 2 more; Belgrano, ¼; and ditto debenture, 2. Melbourne fell 4½; and Cape Town, ½. Saturday was a good day; and prices were capital. Oriental fully paid and £4 10s. paid rose ½ each.

ELECTRIC LIGHTING MEMORANDA.

More Outlay on the St. Pancras Electricity Supply Undertaking—The Generation of Electricity by Steam—Metropolitan Electric Railway Schemes—An Old Delusion Revived.

THE experiences of the St. Pancras Vestry in connection with their electric lighting enterprise, are already extensive and peculiar; and every week adds to the tale. As will be seen by the report which we give in another column, the latest surprise provided for the ratepayers by the parish Electric Lighting Department arises in respect of the steps required to be taken to deal with what is somewhat euphemistically styled "intermittent lighting"—meaning the tendency of the electric lights to go out at frequent intervals and inconvenient moments. Thus it appears that one of the earliest of the failings exhibited by this system of lighting is still a familiar shortcoming. What the ratepayers will probably esteem the gist of the new matter is that a further expenditure of upwards of £8000 was proposed with the object of rearranging the distributing plant, and that this large amount, and more, was cheerfully voted by the Vestry. It is an interesting subject of speculation to inquire when the capital account of the St. Pancras Electricity Department will be closed, and the undertaking left to provide for itself. But such a consummation, however devoutly wished for by those members of the Vestry and others who have the interests of the ratepayers at heart, is not yet in sight.

The current number of the "Electrical Review" contains an abstract of, and a useful criticism upon, a paper recently read by Mr. J. S. Raworth, of the Brush Company, on the cost of

steam power. This is always a subject of interest for engineers; and it must be conceded that, whatever else the electric lighting movement has or has not done, it has at least caused the concentration of a greatly heightened interest in the problems of stationary steam-engine working. Before this new industry appeared, the study of the stationary engine was confined to mill and water-works engineers; and very few such motors of sufficient size to make it worth while to work out the ultimate refinements of economical performance in connection with them were to be found outside factories and pumping-stations. When central station electric lighting became practicable, the economy of the stationary steam-engine presented itself under novel conditions to a fresh order of students; and it was not immediately recognized by the electricians who had to do with the designing and management of these establishments that the problems of power generation which confronted them demanded for their satisfactory solution a knowledge of mechanical engineering even more than acquaintance with the science of electricity. The rights of this matter are now better appreciated by electrical engineers, whose education in this respect was much advanced by Mr. Crompton's teaching on the subject of the "load factor" and its influence upon the cost of electricity supplied from a central station. Mr. Raworth is eminent as an engineer who has addressed himself to the task of improving the stationary steam-engine, with particular regard to the requirements of electricity generation; and he has succeeded in making an engine which is well spoken of by competent judges. Our contemporary, while awarding due praise to Mr. Raworth's mechanical talent, allows it to appear that, in its opinion, the pressing necessity of the future for electric lighting stations is something different from, and more than can be effected by, the most improved steam-motor. "So long as the load factor in an electric station is so small, the first cost of plant must always be a very serious item. This item shows no tendency to decrease in importance. The visionary day-load remains as visionary as heretofore; and the present state of electric lighting, so far at least as the production of current is concerned, cannot be described as having reached any degree of finality. The electric lamp by which we now ought to be writing"—a mysterious phrase, this—"receives its energy every moment from an engine several miles away, which could not stop for a second without extinguishing the lamp. Should these things be; and does such a method of working appear fit or proper to engineers generally?" The bitter cry is thus raised once more, for some better system of manufacture which will "do for electricity what the holder does for gas." And to this piteous appeal there is no more response than could be given to it eighteen years ago.

An interesting scheme for facilitating through traffic on the Metropolitan District Railway route between the City and Earl's Court has been prepared by Sir Benjamin Baker, and is given in a report to the Shareholders' Association of the railway. It is for the under-tunnelling of the main line of the railway, for the construction of a subway to be worked by electric locomotives between the terminal stations named. The line would appear to be intended to be of full gauge, because at Earl's Court it would rise to the level of the existing line, with which it would make a physical junction. Here also the electric locomotives would be changed for steam locomotives, which would take the express trains on the remainder of their journey. There would be only one intermediate station on the low-level line, at Charing Cross. Here the new line would have platforms 63 feet beneath the District Railway platforms; and at the Mansion House terminus the corresponding depth would be 71 feet. As the District Railway itself is underground at these points, the subway would be somewhere about 100 feet beneath the street level, which would not cause any special inconvenience to passengers, as hydraulic lifts would be provided. Sir B. Baker says there will be no difficulty in carrying out the scheme, and as there would be hardly any landed property to be acquired, or way-leaves to be paid for, nearly the whole of the capital expenditure would be on construction and equipment. The estimated cost of the railway works and land for the length of five miles of double line is a round million, with close upon half a million more for equipment and expenses. A Bill is to be promoted next session for this object; and, meanwhile, an independent Company are proposing to make an electrical subway along the Strand route between the City and Kensington. The need for through communication between the City and the suburbs is a great and growing one; and there is something heroic about the attempts that are being made to supply this requirement without interfering with anything or anybody. Here, if at all, electric traction ought to succeed; for there is nothing in a subway to prevent the application to this purpose of the most economical method of electricity distribution.

It is a pity that the general public should still continue to be dazzled with electric traction schemes that have the slenderest prospects of either working or financial success. The current number of the "Illustrated London News," for example, contains a special article, adorned with attractive pictures, of somebody's "electrical cabs," which are to supersede every other form of motor carriage in the near future. These carriages are to be driven by electricity stored in accumulators; and the article states that this method of driving vehicles has been abundantly proved successful, especially in tramway working. It is too much to expect the conductors of such a paper as the "Illustrated London News" to know all about the state of electric traction on common roads; but it is rather too bad that they should lend themselves to the promulgation of claims which very little investigation would have shown to be baseless. An inquiry, for instance, as to where a tramcar driven by an accumulator system can be seen, would have been sufficient to expose the hollowness of this particular pretension. It is one thing to have a robust faith in the future of accumulator cars, whether for tramways or common roads; and it is something quite different to say the thing which is not with regard to the actual facts. Electric cabs may, in the fulness of time, be seen running about the streets of London. It would be a good thing, perhaps, to have them here. But the fact of the matter is that the history of accumulator traction for rail or road is a record of unmitigated disaster, involving the wreck of fortunes and the disappointment of every hope that has been built on the idea.

MORE ABOUT THE STANDARD OIL COMPANY.

In concluding our first notice (see *ante*, p. 842) of Mr. H. D. Lloyd's book on the industrial monopolists of the United States, we indicated that he has something of interest to narrate concerning the oil traders. Mr. Lloyd loses no time in introducing his readers to the facts of the great "oil strike." At first the petroleum industry was open to everybody who cared or had the intelligence and capital to go into it. "Everywhere the scene was of expanding prosperity;" but things speedily began to go wrong with the happy oil men. The market moved erratically, and business men became gamblers. The industry was convulsed; and out of the wreck emerged a single group of half-a-dozen men who were seen to be "rising to the power and wealth which have become the marvel of the world." The beginnings of the great oil combination were laid, as usual, in a special arrangement with all the big railroad companies, without whose co-operation the oil could not be moved. Under this contract, the railway companies were to double their rates for carrying oil to all producers except the new combination, and to hand over to the latter the amount so realized. The arrangement was duly carried out; and forthwith all oil producers and refiners outside the charmed circle had to quit the business, glad in some instances to be bought out at 50c. to the dollar—"that or nothing." Mr. Lloyd writes well; but he is a victim to the weakness of most young American writers, and strains after effect so continuously that his facts can with difficulty be extricated from their setting. Mainly for this reason we cannot give a clear account of the manœuvres which resulted in placing the Standard Oil Company in sole possession of the field. Originally it seems that the promoters of this concern made the excuse, for the peculiar character of their dealings with the railways, that the oil-refining business of the town of Cleveland, where they began operations, was unremunerative to the numerous small firms engaged in it; and their enterprise was directed to the rescue of the local trade from this condition. As the French proverb has it, "appetite comes with eating;" and accordingly the fruits of combination proved so inviting, that the process was pushed to the utmost by every available means. Mr. Lloyd gives some picturesque accounts of the manner of treatment followed by the would-be monopolists in expelling their trade rivals and stopping fresh competitors; but for these stories we must refer the curious to his pages. The enterprise was not an easy thing to carry through, for as the rising monopolists had their hand against everybody, so everybody's hand was against them. At one time, one of the principal railway companies broke away from the compact with the oil ring, and made a determined attempt to get control of the oil business for itself. In order to do this, the railway company started a "mistletoe corporation," which was equipped on the largest scale with oil-cars, pipe-lines, and refineries. Forthwith the managers of the Oil Trust saw that this sort of thing must be stopped; and as the end could not be attained by the oil combination alone, the co-operation of all the other railways was obtained to "freeze out" the rebellious line. A relentless war of rates was commenced; and though the rebel company carried oil for 8c. a barrel less than nothing, the other railways underbid even these ruinous rates, until the insurgents were fain to sue for peace, which was only granted after all their oil equipment had been parted with to the stronger party, and they were put under the obligation to support the Standard Oil Company for ever against all outsiders. The support took the form of a differential rate for the carriage of oil, and the refusal of cars to other firms. There was no secrecy about the matter. The railway managers simply told the outside refiners that the Standard Oil Company would be charged specially low rates of freight, which would not be granted to anybody else, and that the outsiders would neither get cars sent to them by the railway company nor be permitted to put cars of their own on the road. There was no power to which the outsiders could appeal, to make the railway companies show them fair play. An action was commenced against the monopolists in the Pennsylvania State Court, in the course of which these facts leaked out; but it came to nothing.

The last independent effort of the oil producers took the shape of the Tidewater Pipe-Line, which was the first successful attempt to realize the idea, often broached, of a pipe-line from

the oil region to the seaboard. The associated railways and the Oil Trust decided that the new competitor should be fought to the death. The railway rates were, therefore, cut so low that the managers could never be induced to disclose them. Finding this course ineffectual, the combination put pressure upon the independent refineries which the new pipe-line had been made to supply; and these were bought out. Then the Tidewater built its own refineries. But the unequal war could not continue for long. "The Tidewater's managers were nearly worn out. These tactics of corrupting their officers, slandering their credit, buying up their customers, stealing their elections, garotting them with lawsuits founded on falsehoods, shutting them off the railroads, and plugging up their pipe in the dark, were too much. They entered into the pool." Next, a funny thing happened. Before the Tidewater appeared on the scene, the Oil Trust had no pipe-line to the sea, but depended upon the railroads with which it was associated. The railway companies helped their allies to ruin the trunk pipe-line, which thus passed into the hands of the Oil Trust, and was immediately used by the latter to the detriment of the former. The Trust no sooner obtained control of the Tidewater line, than it was discovered that the resources of the railways were totally inadequate to the task of getting the oil to the seaboard; and accordingly the Trust set about the construction of a system of trunk pipe-lines which superseded the railways. This was a supreme stroke of the genius that goes to make conquerors.

In 1887, the producers of petroleum were persuaded by the managers of the oil combination to try the effect of diminishing the output, with the object of raising and maintaining the price. This is the pet remedy for unprofitable business favoured by our own Federated Coal Miners; and it is instructive to follow the course of the experiment carried out in the year named by the American oil producers, described by Mr. Lloyd under the name of the "shut-down." The producers entered into an agreement with the Oil Trust to reduce their output by a stated quantity, in return for which they were to receive a share of the extra profit that was to be made on the large stock held by the Trust. The arrangement was carried out with a high degree of fidelity for a whole year. Owners of wells were persuaded to altogether cease working, and people were prevented from drilling new wells—by moral suasion, of course, if possible; but the obdurate learnt by experience that accidents occasionally happened to the plant of those who ventured to oppose the will of the majority. When the producers claimed their promised reward, they received a cheque for a sum between $200,000 and $250,000, which had to be divided among about a thousand of them. Naturally, this result was a great disappointment. Another lesson, as to the effect of stocks in keeping down prices, may be learnt from this experiment. It had been placarded all over the country that the magnanimous oil combination had 6 million barrels of oil which was to be sold for the benefit of the producers. The effect on the market was depressive, not stimulating. "Not knowing when or at what price this vast amount would be unloaded, buyers, both for use and for speculation, would be made timid, and prices would be held in check." So it happened that, though the price of oil eventually did go up, this did not come to pass until every drop of the stock allocated to the producers had been cleared off. So that the producers lost and the Oil Trust gained all round over the deal—another testimony to the force of genius. Part of the same stock of oil was to be sold for the benefit of the working men whose occupation was taken away by the "shut-down." This was to be a sort of strike fund, in effect; and, like all such funds, it did not "pan out" according to expectations. Men who had been earning $12 a day received at most $1 a day while "playing." So ended the greatest economic experiment of the kind that was ever tried in any country.

The oil exchanges which were once held in several large cities of the States one after another shut up because there was no open market for oil. The most remarkable of Mr. Lloyd's revelations, however, is that there yet remain in north-western and western Pennsylvania, after thirty years of monopolists' aggression, an independent body of oil producers and refiners who are engaged in fighting their way to the sea by laying a pipe-line of their own, in spite of all opposition. Every time a railway has to be crossed by the pipe, the railway company refuse their consent to the crossing; and the promoters of the pipe-line are compelled to go to law to obtain the right of way, which is never refused by the Courts. At one place, where the Erie Railway Company had a bridge over a stream, in the bed of which the pipe was to be laid, the Company sent a hundred armed men, with a cannon, to dispute the passage. For weeks and months this state of private war continued, until at last, in February, 1893—the date must be given to show that this is not a tale of the "dark ages"—the pipe-line company gave it up, and took another route. The peculiarity of this new line consists in its being intended to convey refined oil ready for the lamp. One would like to hear more of this undertaking.

A good deal of Mr. Lloyd's space is devoted to personal narratives illustrating his case. Thus we have the painful experience of one Rice, a refiner who committed the unpardonable offence of trying to carry on his business for his own advantage, and found himself sorely hindered by the Standard Oil Company, and their associates, the railways. There is another sensational story of a man who was reported to have been bribed to blow up a refinery, and much more of the same lurid stuff, all set out with the redundant verbiage of the modern American journalist, which makes most tedious reading.

The history of natural gas follows the tale of the oil trade. As soon as the new kind of fuel was discovered, it was made use of by an application of the experience gained in oil. It is stated that the town of Toledo began in 1887 to be supplied with the new fuel through pipe-lines by two companies, originally supposed to be competitors; but soon discovered to be one—and that one no other than the inevitable Oil Trust! The same hands began to play the same old game of discriminating between different customers with a view to securing ulterior advantages. The people of Toledo took alarm at the proceedings of the gas companies; and, after two years' agitation in the State Legislature, power was granted to the Municipality to supply the town with natural gas. As usual, however, it was one thing to obtain the preliminary statutory powers, and another to carry them into effect. The Standard Oil Company flew to arms; and the question of who should supply Toledo with natural gas was fought out through all manner of issues.

PERSONAL.

The will of Mr. W. A. Cogar, the late Secretary of the Gas-Meter Company, has been proved; the personalty amounting to £13,303.

Mr. J. Budd, Assistant-Surveyor to the Gravesend Corporation, has been appointed Water Engineer and Borough Surveyor of Leominster.

The Davy Medal of the Royal Society has been awarded to Professor Henri Moissan, for the use of the electric furnace in the preparation of refractory metals.

At the recent School Board election for the united district of Gravesend, Mr. J. Davis, the Engineer and Manager of the Gravesend and Milton Gas Company, who was a candidate for one of the seats, was duly elected.

Dr. Pole asks us to say that the statement in our last number (based on his own impression), that he was "one of the three oldest living members" of the Institution of Civil Engineers, proves to be inaccurate, as a few additional antecedent names have been found.

Among the newly-elected Mayors, we notice the names of Alderman S. A. Sadler, of Middlesbrough, and Mr. A. Whitehead, of Salisbury. The former is well known to our readers from his connection with the great firm of chemical manufacturers in the town of which he is now Chief Magistrate, as well as for his occupancy of the presidential chair of the North of England Association of Gas Managers two years ago. Mr. Whitehead is the Secretary of the Salisbury Gas Company; and the present is his second year of office as Mayor. As far as we are aware, the position is unique. Mr. L. Hart, the new Mayor of Ramsgate, is the Chairman of the Broadstairs Gas and Water Company and a Director of the Isle of Thanet Gas Company. His election was proposed in very cordial terms by Mr. Alderman Emett, who characterized him as a man possessed of good commercial abilities, which, he said, would be devoted to the advancement of the borough, and whose probity and honour were well known to everyone.

Mr. F. Egner's Paper on Inclined Retorts.—Mr. F. Egner asks us to correct some errors in the table appended to his paper read before the American Gaslight Association, as given in the "Journal" last week. Basing his calculations for lines 10 and 11 on figures supplied to him by the Superintendent of the works referred to, he arrived at the results given in the last three columns of the table. But later information—received, as he says, at the eleventh hour—necessitated the corrections to which he alludes. Line 10, the figures should be: Total annual cost of manipulation, $69,428·80; cost per 1000 cubic feet for manipulation only, 9·15c.; total economy by use of "slopers," $27,843·30. (In the table, the figures are $55,728·80, 7·35c., and $14,143·30.) Line 11, the figures under the above headings, which now stand $69,928, 9·22c., and $28,342·50, should be $103,628, 13·67c., and $62,042·50.

Institution of Junior Engineers.—The opening meeting of the sixteenth session of this Institution, of which Mr. Walter T. Dunn is the Secretary, was held on the 6th inst., at the Westminster Palace Hotel. The preliminary business included the announcement of the admission of 28 new members, the presentation of the Institution's premium to Mr. F. J. Bancroft, of Hull, for his paper on "The Stability of Tall Chimneys," and a cordial vote of thanks to Mr. A. Denny for his services as President. Mr. Denny then introduced the President-Elect, Mr. A. R. Binnie, M.Inst.C.E., the Chief Engineer of the London County Council, who proceeded to deliver his Inaugural Address, the principal portion of which was devoted to considerations with respect to some of the ways in which water enters into and demands the professional attention of the engineer; sources of supply, rainfall observations, reservoir capacity, durations of drought, dams, and embankments, were touched upon. Sewage works processes as adopted in London were also alluded to, and the satisfactory results achieved were pointed out. A hearty vote of thanks was passed to Mr. Binnie for his interesting address.

NOTES.

A Use for Carbonic Acid Snow in Coal Heaps.

It is a trite observation that in the course of advancing material civilization the scientific curiosity of one age becomes the technical commonplace of the next; but if a suggestion recently advanced by a correspondent of "Engineering" is carried out, the process will receive an exceptionally striking illustration. Mr. Henry Brier, writing on the subject of the prevention of fire on shipboard, reverts to the recommendations that have often been brought forward for the employment of carbonic acid for this purpose. Reference is made to the suggestion of Professor Lewes that the spontaneous ignition of coal cargoes would be prevented if all the interstices of the mass were filled with carbonic acid gas. Mr. Brier observes that, in order to carry out this idea, it would only be necessary to make the coal-holds gas-tight, with merely a small outlet for the escape of the surplus carbonic acid, which should be covered with a non-return flap. It is further pointed out that it is more especially at the commencement of the voyage, when the coal is fresh and capable of absorbing oxygen rapidly, that the presence of carbonic acid in the atmosphere would be invaluable in checking this oxidizing process. Mr. Brier accordingly suggests that a convenient way of obtaining the carbonic acid would be to put a few blocks of the solid form of this compound —that is, carbonic acid snow—under the hatches of colliers, so as to occupy the centre of the cone of small coal usually found in this place, from which any spontaneous ignition generally starts. This article may now be obtained packed in drums, in which it will keep and carry for long distances with very little loss. Experiments made some time ago by Mr. Geoghegan, of the St. James's Gate Brewery, Dublin, showed that blocks of several hundredweight of carbonic acid snow lost weight at a very uniform rate of about 12 lbs. per 24 hours. Here, then, Mr. Brier thinks, is the very way of saving coal cargoes from spontaneous ignition, by simply burying a sufficiency of carbonic acid snow under the coal, and allowing it to gasify as it will.

The Net Cost of Different Modes of Lighting.

In a paper on the above subject read by M. Joly, of Cologne, before the German Association of Gas and Water Engineers at their meeting in Berlin last June, the author gave the results of a number of photometric trials of various systems of lighting, which were carried out by the Electricity Society of Cologne. Altogether, 29 different burners were tried; two mantles being employed, on an average, per burner for six or eight observations. The unit of light chosen was the Hefner; and the photometer used was a Lummer and Brodlum. An average duration of 400 hours was taken as a basis for the mantles; but the greater number were tested after 600 hours, and one of them after 1000 hours. The author subsequently found the comparative net cost of lighting with electric arc and incandescent lamps, ordinary and incandescent gas-burners, incandescent alcohol lamps, and petroleum burners. As the term of comparison, he took the intensity of 16 Hefner units (13·2 English candles) for calculating the cost per hour. The following figures were arrived at: Electric incandescent lamps, 3·98 pf. (0·5d.); coal gas, slit burner, 2·56 pf. (0·32d.); do., argand burner, 2·13 pf. (0·26d.); do., Siemens precision burner, 1·60 pf. (0·2d.); alcohol, 1·42 pf. to 1·17 pf. (0·18d. to 0·15d.); coal gas, Siemens recuperative burner, 1·26 pf. (0·16d.); do., Wenham lamp, 1·12 pf. (0·14d.); petroleum lamp, small, 1·10 pf. (0·137d.); do., large, 0·80 pf. (0·10d.); coal gas, Siemens flat-flame burner, 0·90 pf. (0·11d.); do., incandescent burner, 0·70 pf. (0·09d.); do. do. (a cheaper mantle), 0·60 pf. (0·075d.); electric arc lamps, small, 0·66 pf. (0·08d.); do., large, 0·58 pf. (0·07d.).

Anthracite Prepared for Domestic Use.

It is reported that the proprietors of the Glyncastle Colliery, in South Wales, have erected an extensive anthracite coal breaking, washing, and sizing plant, in the hope of recovering some of the demand for this kind of fuel which has been lost through the greater popularity and more extended usefulness of gas coke. It is admitted that the trade in the anthracite coal of South Wales is nothing like so lively as that in the same kind of coal raised in the United States. The American output of anthracite is increasing rapidly, while the South Wales deposits have been comparatively neglected, and the trade has languished. There is a large supply of it; the north-western edge of the coal-field showing an outcrop over a length of 35 miles. The coalowners now appear to be taking a leaf out of the book of the gas companies and preparing their commodity for different purposes before putting it on the market. Anthracite burns only on the surface; so that, in order to burn it successfully, it is necessary to have the largest possible proportion of surface to the weight of coal in a stove. It is also desirable that the pieces of coal should be of fairly uniform size, so as to allow of the air passing freely through the bulk. Moreover, slow combustion is essential with anthracite, because, if it is attempted to burn large pieces by the aid of a fierce draught, the coal is liable to decrepitate and fall through the grate before it is half burnt. The Glyncastle anthracite contains 91·67 per cent. of carbon, and 3·93 per cent. of hydrogen. In the present state of the coke market, however, there is little to encourage the competition of anthracite.

Gas Lime for Foul Poultry-Runs.

Some experiments which have been made by poultry breeders have drawn attention to the efficacy of gas lime as a purifier for foul poultry-runs. The use of gas lime as a purifier was brought forward some time ago by Mr. J. Simpson, in a work on "The Wild Rabbit;" and this coming before Mr. W. B. Tegetmeier, the celebrated naturalist, he put the material to the test as a purifier for his fowl-run, wherein the birds have unlimited range. He found that the ground near the fowl-houses became coarse; but the application of a good dressing of gas lime in the autumn or early winter proved most efficient in preventing even a trace of disease—a result which those who rear poultry cannot but regard as almost incredible. Mr. Tegetmeier also found the same efficaciousness in the breeding-pens, the large grass of which is gas limed as soon as the birds have done hatching. By following this plan, he has secured a good growth of sweet young grass for the consumption of the birds in the spring. The lime should, as a rule, be applied at the rate of from 2 to 4 tons per acre, well pulverized with a spade, and spread evenly over the surface, preferably in November, and 2 cwt. of salt in March. In one of his works, Mr. Simpson testifies to the successful rearing of pheasants on warrens so treated. The gas lime, though at first very odorous, is not poisonous, as some people will persist in asserting—the heaps being burrowed into by the rabbits, and scratched by the fowls; while on the score of economy it is not only more efficacious, but very much cheaper than quicklime. This is a matter which might be brought more generally before the public than has hitherto been the case; for a foul poultry-run is almost certain to produce disease among the birds, which, of course, puts an end to their profitableness.

The Efficiency of Steam Cylinders.

In the course of a paper by Mr. R. H. Thurston on the waste of heat in steam-engine cylinders, recently published in the "Journal of the Franklin Institute," a succinct summary of the effects of compounding steam cylinders is given from tests on an experimental engine carried out by Mr. H. K. Spencer. It appears from this statement that a single-cylinder engine does its best work at ratios of expansion of about 4 and 6, unjacketed and jacketed respectively, at a minimum expenditure of 23 lbs. of steam per horse power per hour. The double-cylinder engine brings these figures up to 12 and 17 for the ratio of expansion, and down to 16 lbs. and 18 lbs. of steam per horse power. The triple-expansion engine performs its highest duty unjacketed at 20 expansions, jacketed at 22 expansions, at an expenditure of 15 lbs. and 13·3 lbs. of steam respectively per horse power per hour. It is one of Mr. Thurston's most curious deductions from the consideration of the ideal case of the purely thermo-dynamic engine that, whereas here the efficiency should increase indefinitely with increasing expansions, the introduction of the friction of the engine produces the condition that after a time, with increasing expansion, a maximum efficiency and minimum cost of power are attained. Taking all charges into account, the most economical rate of expansion in the single engine is found to be 5; in the compound, 8; in the triple, 12: and in the quadruple, 16.

"Der Gastechniker."—With the commencement of its 27th volume, our Austrian contemporary, which was one of the few journals devoted solely to the gas industry, last month announced that, in accordance with a decision of the Association of Gas Engineers of Austria-Hungary, its columns would henceforth be opened to the allied industries of water supply, heating, and ventilation.

Professor Lewes's Cantor Lectures at the Society of Arts.—As mentioned in the "JOURNAL" last week, Professor Vivian B. Lewes, F.I.C., F.C.S., is to deliver a course of Cantor Lectures at the Society of Arts on "The Use of Gas for Domestic Lighting." There will be three lectures, the first of which is to be delivered on the 23rd inst., and the others on the two succeeding Mondays. The subjects to be dealt with will include the following: The principles of illumination and the measurement of light; flat-flame, argand, and regenerative burners; incandescent mantles and burners; the effect of globes in diffusing and absorbing light; atmospheric influences and the penetration of light; gaseous illumination where coal gas is not available; oil gas and its properties; manufacture and use of acetylene.

The Frangibility of Glass Chimneys.—With reference to the paragraph on the above subject in the last number of the "JOURNAL," Messrs. H. E. Stent and Co., of Liverpool, remark that the complaints of retail dealers in regard to the short life of the glass chimneys used for incandescent gas lighting, to which the "Ironmonger" had called attention, must have resulted from ignorance of the fact that this defect has been to a large extent remedied by some of the German manufacturers of chimneys, notably Messrs. Schott and Gen:, of Jena, who now supply a chimney which, by a process of secondary heating nearly to the melting-point, is entirely proof against the most violent changes of temperature. This chimney may, they say, be heated almost to redness, and then have cold water thrown upon it, without breaking. This is an experiment which may be easily tried; and, if the chimney in question passes through the ordeal, it should afford convincing proof to the most sceptical that the fracture of chimneys due to sudden changes of temperature has been entirely obviated.

TECHNICAL RECORD.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The Autumn Meeting of this Association was held last Thursday at the Holborn Restaurant. The PRESIDENT (Mr. A. F. Browne, the Engineer of the Rotherhithe works of the South Metropolitan Gas Company) occupied the chair; and he was supported by a good number of members. It was noticeable, however, that, though the bulk of the members of the late South-West Association have enrolled themselves in the Southern Association, consequent upon the amalgamation of the two societies, very few of them were present.

OFFICE-BEARERS FOR 1897.

Mr. CHARLES E. BOTLEY (Hastings), in rising to propose the President for the ensuing year, said he was about to mention the name of a gentleman which would be received by the whole of the members with a great deal of cordiality. It was that of their friend Mr. James W. Helps, who had been their Hon. Secretary and Treasurer for so long. He proposed his election with the greatest pleasure, not only because they were old personal friends, but because Mr. Helps had been connected with the Association for so many years—about twenty, he believed; and for nearly half of that time he had acted as Hon. Secretary. The Association during this period had been an unqualified success in every way; and now that the South-West Association was amalgamated with them, it was to be hoped that there would be increased activity and interest in their work. He was certain they could not do better than have Mr. Helps as their President during the first year of the amalgamated Association.

Mr. W. E. PRICE (Hampton Wick) seconded the motion.

The PRESIDENT said he owed so much to Mr. Helps that perhaps the members would permit him to say a word or two in connection with this proposal. The Committee felt highly gratified at their success in inducing Mr. Helps to allow his name to be put forward for nomination as President, upon the understanding that he would be prepared and willing to resume the secretarial duties, as they could not possibly allow him to vacate his present position at the expiry of his year of office, if they were in any way able to prevent it. The Committee felt certain that no member of the Association could be more acceptable as President than Mr. Helps; for, in addition to his recognized ability as a gas engineer and manager, it was well known that he possessed peculiar fitness for the conduct of affairs, to which was due a great deal of the prosperity of the Association during the nine years, or thereabouts, that Mr. Helps had been their Hon. Secretary. Seeing, too, that he had the most intimate acquaintance with the affairs of the Association, and had necessarily been primarily concerned in the negotiations with the late South-West Association, which was now merged in their own, it was evident that he was the fittest person for the presidency in 1897. The Committee were confident he would receive the most enthusiastic and loyal support during the year.

The proposition was carried by acclamation.

Mr. HELPS said he could assure the members that the honour they had conferred upon him was not a self-sought one. He had no desire—so pleasant had been the duties of the secretaryship—to go a step farther, and take the office of President. At the same time, it did give him a great deal of pleasure that they had conferred this honour upon him; and he trusted that in his hands the prosperity of the Association would not suffer. He felt at this time more especially the honour of becoming the President of the Association, seeing that the South-West body had now been merged in it. Before he came to this part of the country, he was a member, and he believed a member of the Committee, of the South-West Association; and therefore this gave him additional pleasure in being selected as the first President of the united Association. He heartily thanked the members one and all for the spontaneous manner in which they had elected him.

Mr. T. MAY (Richmond) said he did not think they could have a better man for the vacant position of Hon. Secretary than Mr. Douglas Helps, brother of their President-Elect; and he had much pleasure in moving his appointment.

Mr. A. DOUGALL (Tunbridge Wells) seconded the motion, which was carried unanimously.

Mr. D. HELPS briefly acknowledged the confidence reposed in him by the members.

On the proposition of Mr. W. B. RANDALL (Waltham Cross), seconded by Mr. R. T. SIMPSON (Guildford), Messrs. D. Irving and R. Beynon were elected to serve on the Committee, in place of Messrs. A. W. Walker and (the late) J. Thorman.

The Auditors, Messrs. W. H. H. Broadberry and W. D. Child, were re-appointed, on the motion of Mr. CHAS. GANDON (Lower Sydenham), seconded by Mr. T. A. Guyatt (Ely).

NEW MEMBERS.

The following gentlemen were added to the roll of members: Mr. E. J. Lloyd (Guildford), Mr. Frank Prentice (Ipswich), and Mr. B. R. Green (Mitcham).

THE FUSION OF THE SOUTHERN AND SOUTH-WEST ASSOCIATIONS.

The PRESIDENT next called upon the Hon. Secretary to report as to the proceedings connected with the amalgamation of the South-West Association with their own.

The HON. SECRETARY said he had not much to report on the subject, inasmuch as the matter had been so lately before the members that they practically knew all the details of the amalgamation. Matters were finally settled; and the scheme, when brought before the South-West Association, was evidently satisfactory to them, and he believed it would prove equally satisfactory to the Southern members. Mr. Humphrys, the late Secretary of the South-West Association, had handed to him a cheque for £32 8s. 4d.—the balance remaining in the hands of the Association when they became amalgamated. This was rather more than the sum they had calculated upon, which was based on a kind of capitation fee of not less than 10s. per member coming over to the Southern Association. He (Mr. Helps) was glad to say that of the number of members on the list of the South-West Association, 54 had joined the Southern. Out of the 54, nine names were originally on the Southern roll—that was to say, they were members before the amalgamation. The united Association now numbered nearly 160 members; and he thought it was the largest District Association in the United Kingdom. He could only trust that, the scheme having been brought to a satisfactory conclusion, the Association would increase in numbers and in the usefulness which, he believed, they would assuredly be to the gas industry at large for years to come.

The PRESIDENT said he thought he would be carrying out the wishes of the members if, in the name of the Southern Association, he bid the South-West members who had joined their ranks a very cordial welcome indeed. Mere numbers were not necessarily a source of strength; but the Committee felt confident that the members of the South-West Association who had come over to them had done so with the determination to do their utmost for the prosperity of the body with which they had sought to be identified. He could not help thinking, therefore, that they would be a true reinforcement to the Southern Association. He was glad to see a fair number of the new members present; and he assured them that they were heartily welcome to the best they had to offer them, and that, in return, the Southern members would expect them to contribute of their best to the common stock of advantages which membership of the Association conferred.

Mr. THOMAS proposed that the Secretary's report on the subject be adopted.

Mr. NORTON H. HUMPHRYS (Salisbury) said that, having been somewhat intimately concerned in carrying the amalgamation through, he had much pleasure in seconding the proposal, because he believed the action that had been taken was one which would tend to the good of the whole of the members.

Mr. T. W. R. WHITE (Sherborne), in supporting the proposition, said, as President of the now defunct South-West Association, he was delighted that Mr. Helps had been elected to be President of the Amalgamated Association for the first year of its existence as such. Mr. Helps had always worked loyally and well; and he was sure the South-West members would rally round him to an extent that he had a right to expect. He expressed the hope that the future of the Association would be a bright one.

The proposition was unanimously carried.

Mr. W. E. PRICE then read the following paper:—

THE RESIDUALS MARKET.

The subjects of this paper are always of interest and importance, and of corresponding anxiety to all gas managers. At no time have they answered to this description in a greater degree than during the past twelve or eighteen months. Following, as this period has done, a winter and spring abnormal both in temperature and gloom, and in gas and fuel consumption, the unprecedented decrease in the market value of residuals in general, and sulphate of ammonia in particular, has been most keenly felt by even the most prosperous.

During the years 1894-5—following an unusually active period of strikes, especially in the coal trade, and consequently of high prices for coal, when in many cases the charge for gas had to be increased—a large proportion of gas undertakings were able or were induced to lower their prices. Then came the extremely mild winter and spring of 1895-6, and with it a falling off in the consumption of gas, especially when compared with the winter period of the previous year. The effect on the balance-sheets of most undertakings was the reverse of what is desirable. At the same time, the state of the residuals market was becoming a serious anxiety to those who hoped to have been able to rely upon coke, tar, or sulphate of ammonia to counteract the effects of the weather just referred to. Unfortunately, the market also has been in a drooping condition since the break-up of the hard weather in the spring of 1894, more particularly in the case of coke and sulphate of ammonia, both of which markets have been in an almost unprecedented condition—sulphate never having been so low in value as at

present. Tar is the only primary residual which has increased in value since 1894.

Coke.

Taking the residuals in order, the coke market since about the middle of 1894 has been, and is now, in a very unsatisfactory condition. The prospect, though, of obtaining better prices in the immediate future seems more hopeful. No doubt the mild winter and spring previously referred to have been responsible for the steady and continuous fall in the price. Coming, as this period did, after a winter season when the demand for coke was unusually heavy, and the price above the average, producers were loth to sell at the prices obtainable. In addition to this, the demand for fuel was below the average, owing to the climatic conditions; the obvious result being the accumulation of abnormal stocks, with increase of breeze and cost of labour in stacking.

It is hardly necessary to refer to the well-known efforts to reduce stocks under these circumstances, by sending large quantities of coke from the home district, at figures lower than the home price. Does anyone gain thereby, except the railway companies or other carriers? It is further stated that coke has even been imported; but surely the home producers have it in their power to stop this. If every effort were made to prevent the accumulation of stocks by selling as manufactured at the best obtainable prices in the surrounding districts, labour of stacking and loss of bulk would be avoided.

Unfortunately, the coke fire is not a general favourite on the domestic hearth. It fails to give that sense of cheerfulness and comfort which makes a coal fire so attractive; and it does not lend itself to those frequent attentions which constitute such a very harmless and convenient safety valve to human feeling. Coke must be broken into small pieces before it can be used with success in a small or moderate sized grate; otherwise the fire has to be abnormally large to burn brightly. But, broken by machinery to a suitable size, it is increasing in demand; and in most cases, a fresh customer for broken coke implies an additional user. No doubt a great deal more can be done in this direction to induce a local market.

Tar.

The state of the tar market has been the only exception to the otherwise wholesale "slump" which has taken place. It is the bright spot, and that by comparison only. Reference to Table I., will show that, whereas tar had an average market value of 13s. 7½d. per ton in 1893, the average of nine months in 1896 has been 21s. 6½d.

TABLE I.

Average Price of Tar per ton.

	1893.	1894.	1895.	1896.
Lady-day Quarter	12s. 4d.	15s. 2½d	19s. 7½d.	20s. 9d.
Midsummer ,,	13 0	14 8	19 9½	21 1
Michaelmas ,,	13 1	16 4¼	19 6½	22 10
Christmas ,,	16 1	18 8	21 2	—
Average	13s. 7½d.	16s. 3d.	20s. 0d.	21s. 6½d.

The maintenance or increase of value has no doubt been brought about by the rise in the value of some of the products therefrom, including pitch, benzols, and naphthalene, among others. Table II. gives the values of tar, pitch, benzol (90 per cent.), anthracene, and naphthalene, from 1893 to Sept. 1896.

TABLE II.

1893.	Pitch. Per Ton.	Benzol. Per Gallon.	Anthracene. Per Unit.	Naphthalene. Per Ton.
Lady-day Quarter	26s. 7½d.	1s. 9½d.	1s. 1¼d.	—
Midsummer ,,	24 0¾	1 6	1 0¾	—
Michaelmas ,,	23 10½	1 5	1 0½	—
Christmas ,,	26 8¼	1 5¾	1 0¾	—
Average	25s. 3¾d.	1s. 6½d.	1s. 0d.	—
1894.				
Lady-day Quarter	27s. 6¾d.	1s. 3¼d.	1s. 1¼d.	—
Midsummer ,,	27 8¾	1 1¾	1 2¼	—
Michaelmas ,,	32 3	11¾	1 1¾	—
Christmas ,,	38 7	1 1¾	1 1¾	—
Average	31s. 6¼d.	1s. 1¼d.	1s. 1¾d.	—
1895.				
Lady-day Quarter	33s. 7¼d.	1 1	1 1	—
Midsummer ,,	34 2¾	11¾	1 1	—
Michaelmas ,,	37 1¾	11¼	1 0¾	23s. 4¼d.
Christmas ,,	37 5¾	1 7¾	11¾	38 8
Average	35s. 7d.	1s. 2d.	1s. 0¼d.	31s. 0d.
1896.				
Lady-day Quarter	34s. 5¼d.	2s. 1d.	11¼d.	45s. 3¼d.
Midsummer ,,	31 9¾	2 3	10¾	57 6
Michaelmas ,,	31 7	3 9¾	10¾	63 8
Average	32s. 7¼d.	2s. 9d.	0s. 11d.	55s. 5¾d.

Pitch steadily increased in value during 1894-5, and has kept steady this year at an average price for nine months of 32s. 7¼d. per ton.

A notable rise has taken place in benzols this year, after a period of very low market value. At Michaelmas, 1895, the value of 90 per cent. benzol was 11½d.; at Michaelmas, 1896, it was 3s. 9¾d.

The low price of benzol in 1894-5 offered an inducement to apply it to enriching purposes; and large quantities were consumed, with great success. As the production of this material has hitherto been mainly from coal tar, stocks were considerably reduced, with a consequent rapid rise in price during 1896.

Anthracene has been very steady, with a slight decline. This material is controlled by the Anthracene Committee, who appear to have been very successful in keeping a steady market, and, it is hoped, a paying one.

Naphthalene has been in demand, and has had an average market value this year of 55s. 6d. per ton.

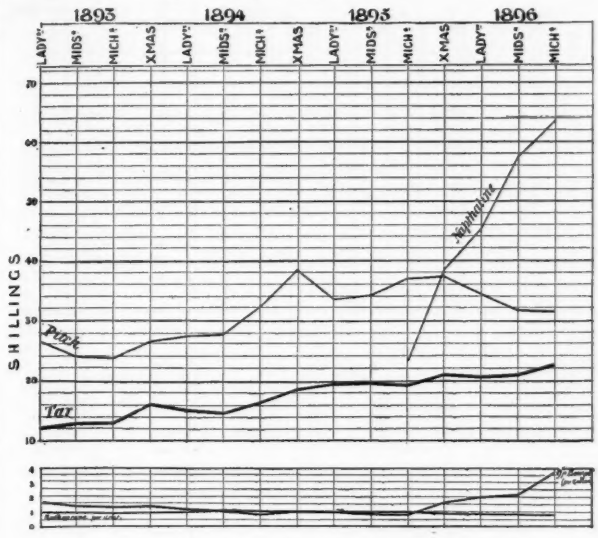


DIAGRAM I.—TAR AND PRODUCTS, ETC., MARKET PRICES FROM 1893 TO 1896.

Diagram I. has been prepared to show more graphically the relative positions and values of tar, and some of the productions therefrom during the years 1893-6. Tar is shown in value per ton at works; pitch per ton, at port; benzol (90 per cent.), at per gallon; anthracene (30 per cent.), at per unit; and naphthalene, at per ton.

Gas Liquor or Sulphate of Ammonia.

This is the unfortunate residual which has suffered most, and has had the blackest record during the past twelve months; and it is to be hoped that the climax has been reached. The average price of sulphate in the year 1893 was £12 11s. 4d. per ton; in 1894, £13 6s. 5d.; in 1895, £9 15s. 9d.; in 1896 (nine months), £8 1s. 8d.

Reference to Diagram II. [next page] will show the annual values from 1867 to 1896, also the equivalent value of nitrate since 1880. It will be noticed that a comparatively steady period occurred between 1886 and 1892, which was succeeded by a considerable rise and fall in the four following years. Nitrate of soda, on the other hand, has had a downward tendency since 1885; and to-day, like sulphate, it beats the record.

Diagram III. shows the relative quarterly values of sulphate of ammonia, gas liquor, and nitrate of soda from 1893 to 1896, and the actual figures are contained in Table III.

TABLE III.

Quality and Average Prices of Sulphate of Ammonia, Ammoniacal Liquor, and Nitrate of Soda.

1893.	Sulph. Ammonia. Per Cwt.	Gas Liquor. Per Ton.	Nitrate Soda. Per Cwt.
Lady-day Quarter	11s. 0d.	7s. 5d.	9s. 11d.
Midsummer ,,	12 3	8 6	9 6
Michaelmas ,,	13 11	9 7	9 9
Christmas ,,	13 2	8 4	9 1
Average	12s. 7d.	8s. 5d.	9s. 7d.
1894.			
Lady-day Quarter	13s. 11d.	9s. 3d.	9s. 7d.
Midsummer ,,	13 8	11 0	10 1
Michaelmas ,,	13 8	11 2	9 2
Christmas ,,	12 1	8 10	8 9
Average	13s. 4d.	10s. 1d.	9s. 5d.
1895.			
Lady-day Quarter	11s. 2d.	8s. 3d.	8s. 10d.
Midsummer ,,	9 11	7 9	8 4
Michaelmas ,,	9 4	7 2	8 2
Christmas ,,	8 10	7 2	7 9
Average	9s. 9d.	7s. 7d.	8s. 3d.
1896.			
Lady-day Quarter	8s. 6d.	6s. 6d.	6s. 0d.
Midsummer ,,	8 0	6 4	8 0
Michaelmas ,,	7 9	6 6	8 0
Average	8s. 1d.	6s. 5d.	8s. 0d.

In the diagram, sulphate and gas liquor take nearly parallel lines but with a tendency for liquor to maintain the better value. The

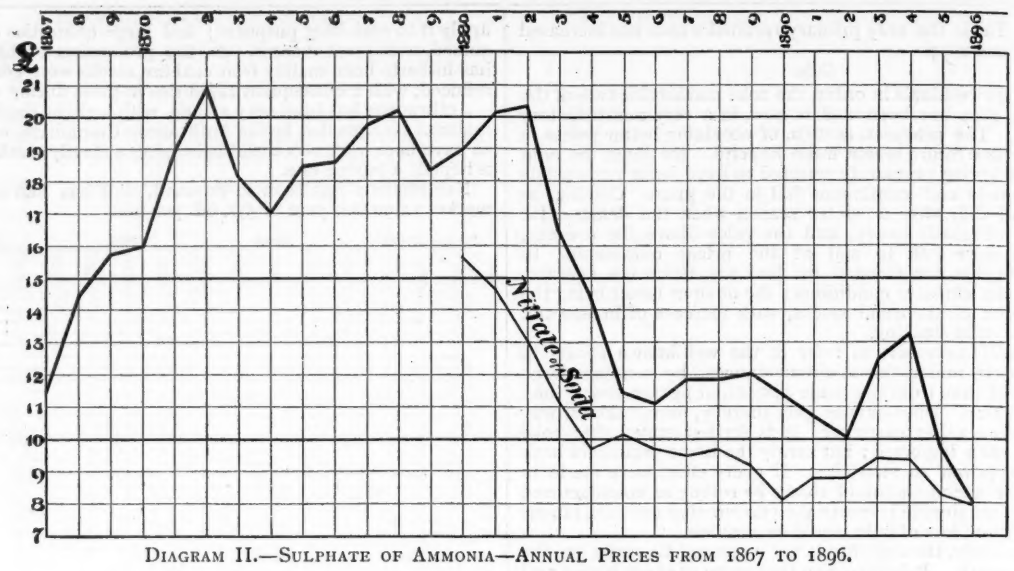


Diagram II.—Sulphate of Ammonia—Annual Prices from 1867 to 1896.

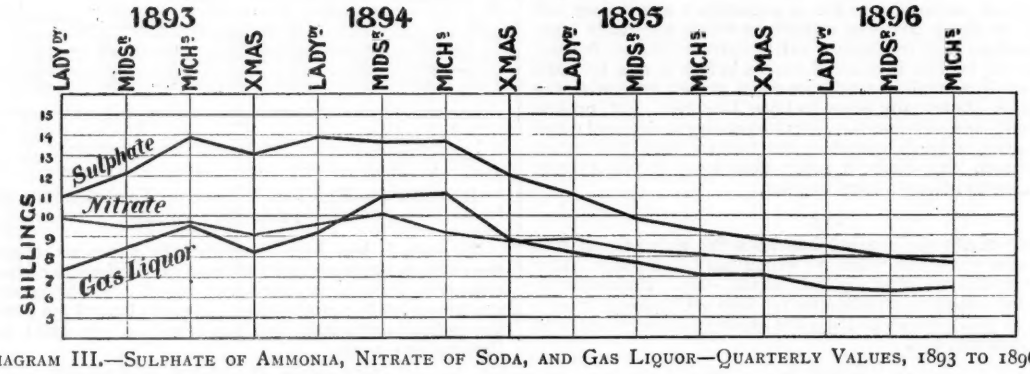


Diagram III.—Sulphate of Ammonia, Nitrate of Soda, and Gas Liquor—Quarterly Values, 1893 to 1896.

nitrate of soda curve has been added to show the position it holds relatively. There is not much evidence that the one has any influence on the other—or, at any rate, to which the influence belongs. Nitrate is distinctly the dearer salt at the present time, even weight for weight; but when it is remembered that it only contains 15 to 16 units of nitrogen, whereas sulphate contains 20 to 21 units, the disparity will be the more marked. Sulphate should be 25 per cent. higher in price, weight for weight, than nitrate of soda.

Sulphate of ammonia being an ultimate production, and one not dependent on the values of any secondary products—as in the case of tar—it has to stand its chance in the artificial manure market by the side of other nitrogenous materials; but when it also has to contend with over-production, like everything else it must suffer. That this is the case, seems apparent by reference to Diagram and Table IV.

The upper part of the diagram shows the total production, export, and home consumption from 1882 to 1895. The increase in production has been remarkably regular, but above the average in 1894-5. Exports almost kept pace with production until 1886, when a considerable falling off took place. This existed until 1891, when a sudden rise occurred, and continued through 1893, since when the decrease has been continuous. Home consumption increased until 1890, since which time it has decreased.

These facts, which have had everything to do with the present position of sulphate, are more vividly seen when plotted out in percentages, as in the lower part of the diagram. There it will be seen that 1886 has never been exceeded in the percentage of sulphate exported. After that a serious falling off took place until 1891, then, until 1893, a sudden rise occurred, since which time the market has continuously declined. The home consumption increased almost uninterruptedly until 1890, since which period the falling off in the percentage used in the British Isles has been so marked as to bring this division of consumption into a position which it held in 1885.

Seeing that reductions have taken place both in export and home consumption, stocks must contain the difference; and the bottom line of the diagram shows that this is the case. The average of stocks between 1882 and 1893 was about 4 per cent.; whereas in 1894-5, it had increased to 10 and 11·7 per cent. respectively. What amount of stocks there are to-day, it is impossible to say; but if the market value can be taken as an indication, there cannot be far short of 15 per cent. in the stores. The outlook therefore is not promising; nor is it clear how this undesirable state of things can be improved.

One of two things must be done—the production must be decreased, or the consumption increased. That the first will obtain is not at all probable, unless the commercial value of the salt becomes unremunerative to manufacturers. An effort must be made to increase the consumption; though it must be admitted the "Home Consumption Curve" on the diagram is far

Table IV.—*Sulphate of Ammonia, 1882 to 1895.*

—	1882. Tons.	Per-centage	1883. Tons.	Per-centage.	1884. Tons.	Per-centage.	1885. Tons.	Per-centage	1886. Tons.	Per-centage.	1887. Tons.	Per-centage.	1888. Tons.	Per-centage.
Exports	47,000	72·3	54,000	72·0	65,000	74·7	70,000	72·2	79,000	74·2	81,500	71·7	83,000	67·5
Home consumption .	16,000	24·6	17,000	22·6	19,000	21·8	21,000	21·6	25,500	23·9	30,400	26·7	31,300	25·5
Stocks	2,000	3·1	4,000	5·4	3,000	3·5	6,000	6·2	2,000	1·9	1,800	1·6	8,500	7·0
Production . . .	65,000	—	75,000	—	87,000	—	97,000	—	106,500	—	113,700	—	122,800	—

—	1889. Tons.	Per-centage.	1890. Tons.	Per-centage.	1891. Tons.	Per-centage.	1892. Tons.	Per-centage.	1893. Tons.	Per-centage.	1894. Tons.	Per-centage.	1895. Tons.	Per-centage.
Exports	87,000	65·4	86,000	64·2	90,000	63·0	105,000	70·0	112,000	73·9	103,000	64·4	112,000	65·5
Home consumption .	41,000	30·8	42,000	31·3	43,000	30·0	42,000	28·0	37,500	24·7	41,000	25·6	39,000	22·8
Stocks	5,000	3·8	6,000	4·5	10,000	7·0	3,000	2·0	2,000	1·4	16,000	10·0	20,000	11·7
Production . . .	133,000	—	134,000	—	143,000	—	150,000	—	151,500	—	160,000	—	171,000	—

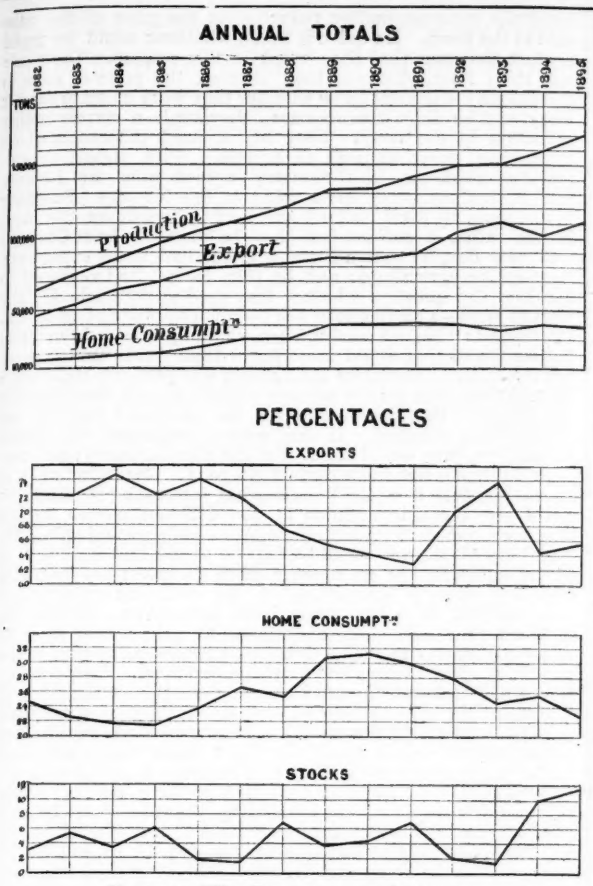


Diagram IV.—Sulphate of Ammonia.

from encouraging. A great deal has been written of the benefits of the uses of artificial manures, and of sulphate of ammonia in particular; but still further efforts must be made before the average British farmer will be raised from his normal position.

Unfortunately the financial position of British agriculture is so unsatisfactory that even though the farmer had the desire to manure his land, he has not the means. It is to be hoped that the cheapness of sulphate may be impressed upon him; and that he will be induced to take advantage of its value.

"The South Eastern Agricultural College," says the "Journal of Gas Lighting," "have issued a circular to farmers, pointing out the very low price to which sulphate of ammonia has fallen, as compared with nitrate of soda. The circular states that since both manures are valuable only for the nitrogen they contain, and as roughly speaking sulphate of ammonia contains 20 per cent. of nitrogen and nitrate of soda only 15 per cent., three-quarters of a ton of sulphate has in it as much food for a crop as a ton of nitrate. Of course, it is true that the nitrogen in the nitrate is accepted as being more effective than the nitrogen in the sulphate; but at the outside the difference in manurial power is certainly not more than 10 per cent.—thus leaving a substantial margin of cheapness in favour of sulphate. When it is also remembered that the more concentrated nature of sulphate means a saving of 25 per cent. on the carriage, and that it can often be bought at still lower rates from local gas-works, it is clear that, for any other than very light sandy soils, sulphate rather than nitrate should be bought at present." Why not dispose of the present stocks to the British farmer for what they will fetch, and thus give him both interest and assistance in the uses of this most excellent artificial manure? This would certainly have the effect of improving the producing qualities of his land and bring clearly to his knowledge the benefits to be derived from the use of sulphate. His desire and ability to purchase more, and to spread the good news of its value among his brother farmers, will be obtained, and producers—and especially the gas industry, as the largest—will be benefited thereby.

This paper has been written with the object of not only placing before the members a few particulars and statistics of the condition, past and present, of the market in residuals of gas-works, but of causing a debate, the result of which perchance may be to induce a better tone on the residuals market. The attempts at a forecast have been but slight, and more for the purpose of raising criticism. If it causes a good discussion, adverse or otherwise, the author will be repaid.

Discussion.

The President said he was sure the members had all listened with great pleasure to Mr. Price's interesting paper, which must have cost a great deal of labour to put together. The author had made a somewhat bold suggestion at the end of the paper; and there must be a large number of gentlemen in the room who knew something about the sale of sulphate of ammonia to local farmers. He suggested that perhaps Mr. Frank Livesey would give them his views on the subject.

Mr. Frank Livesey (London) said he was not prepared to say anything on the paper, which contained a very valuable collection of statistics. Only one proposition was made at the end of the paper in regard to sulphate of ammonia; but he was afraid that it was not very practicable. It was no use going to the farmer, and saying he ought to use sulphate of ammonia. Sulphate of ammonia contained nitrogen; but most plants required something more than nitrogen. What they ought to do was to go to the manure makers, and get them to make up a suitable manure. Sulphate of ammonia was very useful for beet and sugar growing; but he had read reports very often that it was unsuitable by itself for English farmers. He believed a meeting took place only the other day, and that was rather the line it was proposed to take. Some of the Provincial gas companies did a good business in the sale of sulphate of ammonia; and it was suggested that they should work in opposition to the trade, and try to sell their sulphate direct. He did not think that this would be successful; and they would have the manure manufacturers against them. If the gas companies could work with them, they would be more likely to be successful, as it was not all plants that required sulphate of ammonia—they wanted a mixture. Proceeding to refer to the residuals in the order mentioned in the paper, he said that the coke trade was a very mysterious one; for when it got at its worst, very often the pendulum would swing back again, and go to the other extreme. With a bad winter, he should not be surprised to see coke scarce; and then the price would go up. There was already a brisk demand for coke in London. Of course, coke had been sold at a low figure; but the local trade was good. He heartily agreed with Mr. Price when he talked about the carriage of coke. That he thought all of them ought to take to heart, though he could not say his own Company had ever transgressed in the way mentioned. They heard of coke travelling all over the country; and he had himself been called to account by a gentleman in Sussex who supposed that he (Mr. Livesey) was the culprit, and had sent coke down from London to a certain Sussex town. That was not the case, because his Company had no railway communication; and they could not do anything in that way. He considered that, if coke had to be sold cheap, they should let the people in their own districts have it. In regard to tar, it was a curious thing that some tars varied considerably in their value. It might be said that the worse tar they made, the better the gas produced. He was not, however, altogether sure this was the case. If it was not so, then surely they ought to try to make a good tar, and get a better price for it. Complaint had been made of tar because of the amount of free carbon in it. He assumed that the free carbon was decomposed gas. It was carbon that had not adhered to the surface of the retort; or was not left up the ascension-pipe. Pitch made from these tars was inferior; it had no combining power. The Germans and the Belgians had a specification relating to the purchase of tar; and the pitch had to be a soft pitch, and not contain a large amount of this free carbon, which would not make a good patent fuel. Another point about tar that he had noticed was this—that works where there were inclined retorts not only made better tar, but they made a much larger proportion of it. He was told that this had been observed at Brentford—that the tar was improved in quality, and was remarkable in quantity. That was to say, the tar they were getting from inclined retorts had increased by 1½ gallons per ton of coal carbonized since the introduction of inclined retorts. That was a consideration. A gallon and a half of tar was worth 2d.; and 2d. per ton of coal used was not to be despised in these days. Sulphate of ammonia, as most of them knew, had made a spurt upwards—a most remarkable spurt, in fact—during the last week. He believed that some of the large stocks on hand had been sold; and therefore when people found it likely there would be a scarcity, they rushed in. There was one other product he was interested in—that was, cyanogen. In these days, perhaps it was wrong to say they ought to get all the products. Certainly if they could decrease the quantity of sulphate of ammonia made per ton by about half, it was questionable whether or not they would receive a better return. They could not do that; and they could not let ammonia run into the sewers. There was no doubt sulphate of ammonia had improved in value. In regard to cyanogen, he believed himself that it could be very easily extracted from the gas without any labour beyond the ordinary scrubber, and without giving any pressure. Then came the question whether a large production would not bring down the price. Of course it would; but even if it brought down the price, it would be more largely used. Since the patent rights had been decided in the cyanide gold recovery process, there might be a large demand for it. In his own experience, he had had inquiries once or twice a week from people who wished to know what could be done in regard to cyanogen.

The President said there was one point he had rather hoped Mr. Livesey would allude to—that was the effect of breaking coke upon the retail trade.

Mr. Livesey said his experience was that broken coke was not only much better for domestic purposes, but also for firing boilers. The large coke on the furnace-bars left so many air

spaces that they did not get a proper heat. The use of broken coke produced carbonic oxide in the boilers; but that was only a question of the regulation of the air supply. They had all doubtless seen the incandescent fire-mantel. It certainly did give a most remarkable heat; and the fire seemed to keep bright for a considerable time, without much trouble. The difficulty about coke was that there was so much ash in it that it soon stopped the draught, and then the fire became low. The incandescent fire-frame had perhaps been rather overrated; but it did keep the fire bright for a long time.

Mr. S. W. Durkin (Southampton) said the paper had been very generally interesting to the members. Commencing with coke, he thought the author admitted that it was a difficult question to deal with when they had a large bulk of it to dispose of; and it was made still more difficult when a larger concern sold their coke at a cheap rate, and sent it into other districts. Last year he suffered in this way to some extent; and at the present time he was suffering to a still larger extent. The general rule was that, when coal was dear, coke also got dearer; and if he dared to increase the price of coke above the present figure, he would be flooded with coke from another part of the country—nearer London. (Laughter.) It was all very well to say, "Sell your coke in the district;" but if there was not enough absorbing power in the district, all the coke could not be sold. Therefore they must make the best terms at which they could get rid of it. He had for some time past introduced the system of differential rates. He did a good deal of trade with factors on the South-Western system. A lot of the coke went to places where he thought there were no gas-works, or only small ones, where a few trucks of coke would not interfere with their limited local trade. By introducing these differential prices, he tried to cope with the local prices which were being charged for coke; and therefore the various towns which were supplied would not be so much injured. In broken coke, he was doing a large and increasing trade. The poor people were able to get their 28 lbs.; and they were willing to pay at the rate of 1s. per cwt. for it. His Company were also sending broken coke away by rail. In fact, so great had been the demand that he had been obliged to refuse orders for it—their means for coke breaking not being able to cope with it; and therefore those who wanted it, had to look to some other market for it. There was a good deal of coke used in his district for the cement works. To one or two firms he supplied something like 4000 tons a year for manufacturing Portland cement. He had tried to induce a larger local trade by bringing the price down; but he found there was simply a certain demand for coke, and more than that he could not get rid of. The people in his district were used to burning north country coal; and they liked to see a flare in the grate, rather than the incandescent burning of the coke. Tar he was doing fairly well with just at present. But as to sulphate of ammonia, they had been manufacturing it for several years past; and, of course, with others, they had suffered from the lowness of the price. He was much struck by the remark of the author of the paper as to getting at the farmers. When his Company first started making sulphate, they saturated the whole district with literature bearing on the subject, in order to get hold of the farmers; but from what he could hear, they would be better without their custom than with it. They were now doing business with the manure makers. Mr. Frank Livesey had stated that the farmers required something more than sulphate of ammonia for manurial purposes. They wanted a mixture; and this he (Mr. Durkin) did not think gas makers were in a position to supply, but the manure manufacturers were. There was one large concern in his neighbourhood to which he sold a good amount of sulphate of ammonia, at a very fair price considering the market value. He had therefore been able to sell locally without accepting the ridiculous prices that had been offered to him in London. This had helped him very much. He also got rid of a quantity, at a fair price, in another direction where the farmers were more intelligent than the ordinary British farmer; and they made up their manures in the winter time, so as to use them in the spring for their early crops. He never stocked sulphate, because it cost money to store; and taking this into consideration, they did better by accepting a few shillings per ton less.

Mr. J. W. Helps remarked that Mr. Price began his paper by stating that the subject was one of much interest, but at the same time one of great anxiety, to gas managers. He most thoroughly agreed with him. The paper seemed to be rather a curious comment on the prophecy they had all heard many times—they did not hear it so much now, but he heard it years ago—that the time would come when the residuals and the gas would change places, and that they would be able to make so much out of the residuals that they would practically be able to give the gas away for nothing. This prophecy was very far from being realized. Remarks had been made on the subject of coke, about the influx of that material on the Sussex and Hampshire coast; and he believed that a great many engineers close to London had been nearer making enemies in connection with this matter than they had ever been before. He could himself speak most feelingly on this point. In the district from which he came, there was a demand for a certain amount of coke in large manufactories; and his Company would scarcely sell more at 3d. than at 6d. He looked at the matter in this way: It was not fair to send away large quantities of coke, and put the money into the hands of the railway companies, if they did not make a corresponding reduction in the price of the coke sold in the town. He did not think, whatever could be urged against Croydon, that they erred in this respect. Their rule was this: That whenever they reduced the price of coke to merchants (he did not know whether they were going to send it away, and he did not much care), they made a corresponding reduction in the town. They had a fixed difference, which they were never allowed to exceed. With regard to sulphate of ammonia, he thoroughly agreed with Mr. Livesey that it was not much good going to the farmers. Sulphate of ammonia by itself had not any lasting benefit on the land. It was rather a curious fact that, in travelling from Croydon that very day, he met a friend who had had some experience in scientific agriculture; and he (Mr. Helps) had ventured to ask him the question whether they used at their scientifically worked farm—a small one in Kent—much sulphate of ammonia. He replied: "No, we used it when we first purchased the land; but we found that it did more harm than good—that it wore out the land." Therefore Mr. Livesey was perfectly right when he said they must get the manure makers to add something to the sulphate that was useful for the particular purpose for which it was required. If they were to undertake the mixing themselves, they would run foul of the manufacturers; and perhaps do themselves more harm than good. Regarding coke, it struck him that it would be somewhat interesting if Mr. Price could give them, in addition to the different curves on his diagrams, one showing the relative prices of coal and coke. He dared say his answer would be that he would find it difficult to get at anything like an average price for coke; but even if it had only been a comparison of the coal and coke in his own district, it would have been interesting, because he believed that coke was often sold at prices that bore no relation whatever to coal. Cyanides were not mentioned in the paper; but Mr. Livesey had touched upon them. Over-production would undoubtedly mean a great reduction in the price of this material; even in the past year or so, it had been reduced from 5d. to about 3d. per pound. Only the previous week he had a conversation with a gentleman from South Africa who had had a large experience in the use of cyanides in gold extraction, and who said that, while he did not think there was any doubt that cyanide would be used for many years to come for that purpose, England was being beaten out of the market by the Germans, and that he was able to buy cyanide ¼d. cheaper in Germany than in England. However, he (Mr. Helps) was most pleased to find that this gentleman was so patriotic that, in spite of the extra ¼d., he had bought all the cyanide he required in England.

Mr. C. E. Botley (Hastings) said it seemed to him a very absurd thing that they should pay the railway companies money to take coke out of a district, while other people were paying money to them to bring coke in. He had endeavoured to prevent this; and, so far, with some fair amount of success. But while he had prevented coke being brought in, he had prevented himself going out. There was a kind of barricade all round him. He thought that everybody should try to fight his own battles, and do the best he could. If managers were met by an affair of this kind, they should counteract it by cutting through the barricade. He quite agreed with Mr. Durkin that there was only a certain demand for coke, and they could not create any more at present, unless they could produce a new means of using it. Recommending people to consume gas as a fuel was undoubtedly a step in the right direction; but, at the same time, they were curtailing the use of solid fuel. In the majority of cases, those people who adopted gas-fires were those who had been using coke; and therefore, unless they could induce some fresh demand for coke, they would not improve in this direction. The introduction of slot meters and cooking stoves had undoubtedly reduced the small consumption of coke for domestic purposes that they used to have.

Mr. Norton H. Humphrys said there was one point he should like to draw attention to; and it was this: How far were the falling prices—particularly of sulphate of ammonia—and the facts they saw portrayed before them by the black lines in the diagrams, due to what might be called artificial operations by speculators, dealers, and the middle men, who purchased their residuals, sulphate in particular, and "rigged" the market. In the reports in the "Journal of Gas Lighting," reference was made to certain animals, called "bulls" and "bears," and which seemed to change character from time to time. He should have liked to have heard a little as to how far the operations of these particular animals were concerned in bringing about the present low price of sulphate. The point gas managers should have clearly before them was this—that they must get into as intimate contact with the consumer as possible. This was one of the advantages they had secured by the sale of broken coke. They had developed a business in broken coke among a number of small consumers; and they supplied it by the ton or two tons to those who took it at regular intervals, and did not trouble themselves to inquire about the markets, or anthracite, or other things. It seemed to him with regard to this coke question that the unsaleable residue which obtained in the large towns, which must be got rid of somehow or other, and which went floating about from one place to another at a low rate, had a great deal to do with bringing down the price of coke. In his own district, there was a sale for a larger quantity of coke than he made; and a considerable amount was dumped into the districts from

distances at a low price. It seemed to him that they required to have some understanding about this, for this reason: That coke was brought into Salisbury from a distance at 10s. per ton; but if the people who sent it would put it at 12s., they would get rid of it just the same. From his knowledge of local prices, he thought he could get 1s. 6d. to 2s. a ton more, were it not that prices were regulated by the coke from the outside.

Mr. A. E. Broadberry (Tottenham) observed that it had been stated several times that it was very desirable that something should be done to increase the local demand for coke; and he had been thinking whether this was not to a large extent in their own hands. At Tottenham, they had considerably increased the local demand for coke by adopting the manufacture of carburetted water gas. At the present time, they were making close upon 50 per cent. of carburetted water gas, which meant that if they were making all their gas from coal, they would be producing twice the quantity of coke they were doing at the present time. In addition to this, they were using a considerable portion of the coke now made for the manufacture of water gas, which had a very beneficial effect on the coke market. He was almost afraid to tell the members the price they obtained for coke, because, if he did, they might be sending train-loads into the district straightway. (Laughter.) One company who sold their coke at the present time at 8s. per ton were flooding the district; but, notwithstanding this price, the Tottenham Company had not made a contract this year under 12s. 6d., which they attributed entirely to the manufacture of carburetted water gas. Other works were going in for this system; and in a few years' time, when water gas manufacture became more general, it would have a very beneficial effect on the coke market.

Mr. C. Gandon (Lower Sydenham) said there was no doubt the disposal of coke was a very important question for every gas manager; but he thought it was impossible to lay down any hard-and-fast rules which could be observed by everyone. The circumstances must necessarily alter cases. In his own district, for instance, they had to be guided by the prices at which the London Companies were supplying coke, because, if they attempted to get a higher price, they were flooded by coke from other companies—especially the Metropolitan Companies. He could not, however, reproach them for this. The Crystal Palace district was essentially a residential, and not a manufacturing, one. Therefore the demand for coke was small; and consequently they had to send it away. Reference had been made to certain protests that had been received lately, one of which he had received himself—no doubt from the same gentleman—and in it he reproached him (Mr. Gandon) for having sent coke into his district at a lower price than he wanted to get for his own production. It was impossible they could prevent this. The principle he followed was this: They had a certain price; and if they could sell coke in their district at that price, they did. If they could not, they made a small reduction to anybody outside the district; but he did not enter into long contracts at ridiculously small prices. They simply had these two rates; and if they were insufficient, in conjunction with each other, to get rid of the coke, they reduced the price all round. So far as he could see, this was the best course they could take; but the question must be dealt with according to the circumstances of each individual case. He certainly objected, as others had done, to paying money to the railway companies for carrying coke into competing districts. He knew of an instance where two companies were sending coke from different points into one another's districts, and simply competing with each other by selling at reduced prices. This was an absurdity. Sulphate had been a very sore point with all of them. Whether the slight turn of the market would be maintained or not, it was impossible to say. He agreed with Mr. Livesey that it was almost hopeless to induce the English agriculturists to adopt sulphate of ammonia pure and simple. They needed an artificial manure, and would not buy sulphate, both on account of the price and because it was unsuitable for all soils.

Mr. T. May (Richmond), referring to the point as to managers sending coke from one district into another, said that a large number of consumers of coke preferred dealing with the coal merchants rather than the gas company direct; one reason for this being that they could get longer credit. The result was the coal merchant went where he could buy the cheapest. It was simply a question of price.

The President said he was sorry to find that Mr. Price's somewhat novel suggestion as to an effective method of getting rid of sulphate had not met with more encouragement. It appeared they could not do without the middle man; but, as Mr. Humphrys had shown, he was not perhaps always such a help to them as they could wish.

Mr. Price, in replying, thanked the members for the discussion they had given to the paper. He had intimated that his object was to raise a discussion adverse or otherwise; and he thought it had been mostly "otherwise." There was not, however, much in it calling for a reply from him. He did not deal with cyanogen, as he hardly considered it to be of sufficient importance at present. It was in an experimental stage as it were; and very few had done anything with it. As he could not get any information as to market values over any period, he thought it better to say nothing about it. The information he did obtain did not seem at all hopeful. Merchants who were both purchasers and sellers—the middle men as they were called—in cyanogen had told him that the price had fallen; and that there was much being made, especially by the Germans, who were underselling us again. At one time the price of cyanogen was above 1s. per unit; but it had fallen to 3d. or 4d. He was not able to make a diagram of the coke, for the reason that it was not possible to obtain market prices, which had such a distinct local value that it was impossible to give an average rate for the whole of the British Isles. He also agreed with what had been said about going to the manure manufacturer. What he had intended to convey by his suggestion was that, rather than go to the person to whom they generally sold sulphate, and who sent most of it abroad, they should try and induce a home consumption, because abroad sulphate was being made to a considerably greater extent than it used to be; and the curve of exports would show there had been a falling off. But this did not necessarily prove that less had been used abroad, but rather that they were making their own sulphate. Germany especially was turning out more than hitherto; and he believed the rise in the last two years was due to a larger trade with North and South America, though they had had less trade with Germany. The making of water gas, of course, reduced the output of coke; but he did not think that was the best way of looking at it. It was hardly the best means of getting a better price for their coke to make less of it. Whether they sold 100 tons at 10s., or 200 at 5s., they did not get much satisfaction out of it.

Mr. W. B. Randall (Waltham Cross) read the next paper, which was entitled—

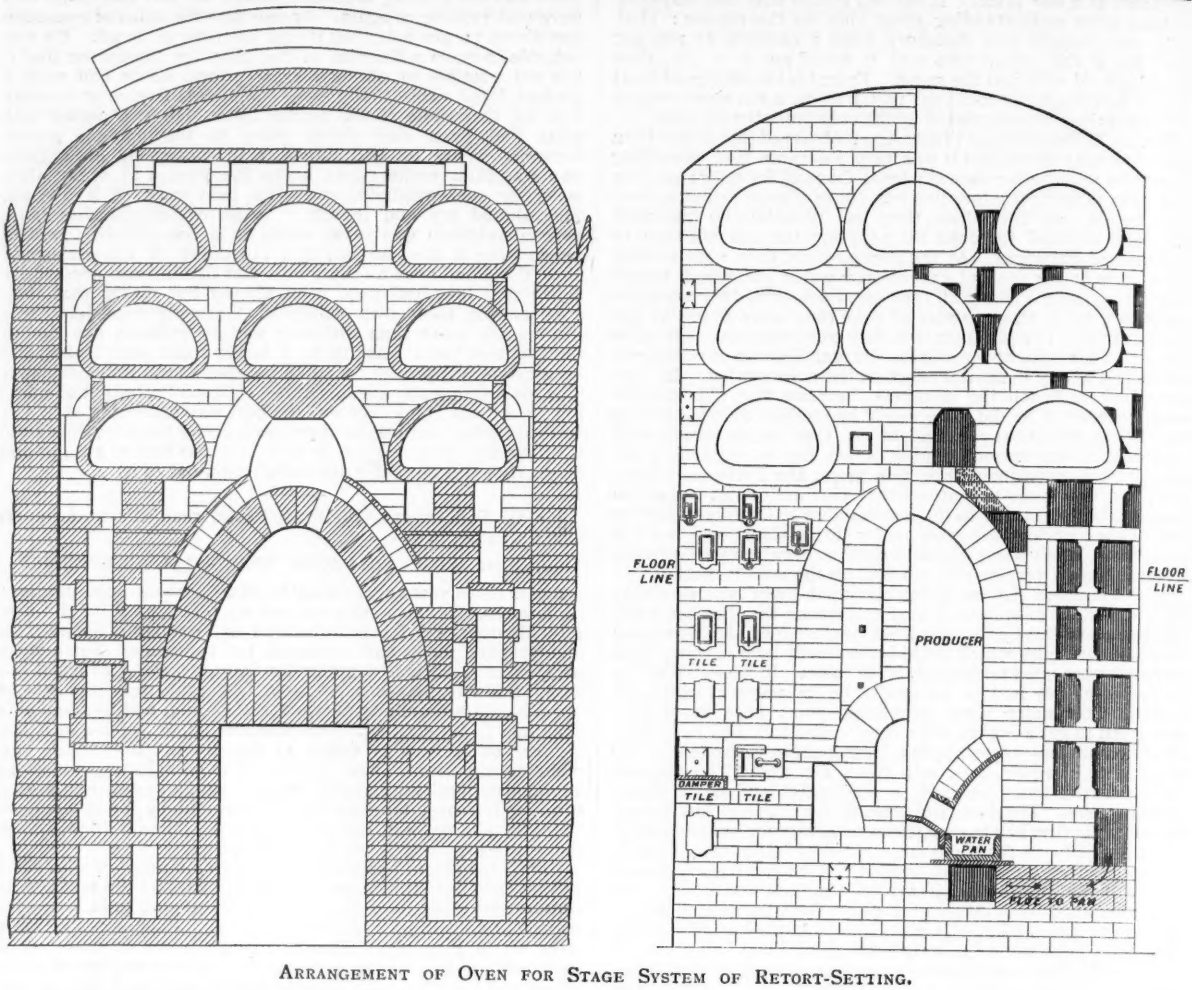
REGENERATOR FURNACES FOR SMALL GAS-WORKS.

About three years ago, owing to causes which need not here be detailed, it became necessary for my Directors to build a new retort-house; and I was instructed to investigate the matter, and prepare plans and estimates for the same. Some little experience in working a generator furnace having satisfied me that it had advantages over direct firing, the next step was to consider the advisability of regenerator firing, and to adopt this principle in its entirety. One cannot but be struck with the number of systems in vogue at the present time, each one claiming superiority; and with a view to selecting the most economical method, I visited several works where regenerator furnaces had been for some time in use, and, by the courtesy of those in charge, was enabled to form a clearer idea of the respective merits of the various principles.

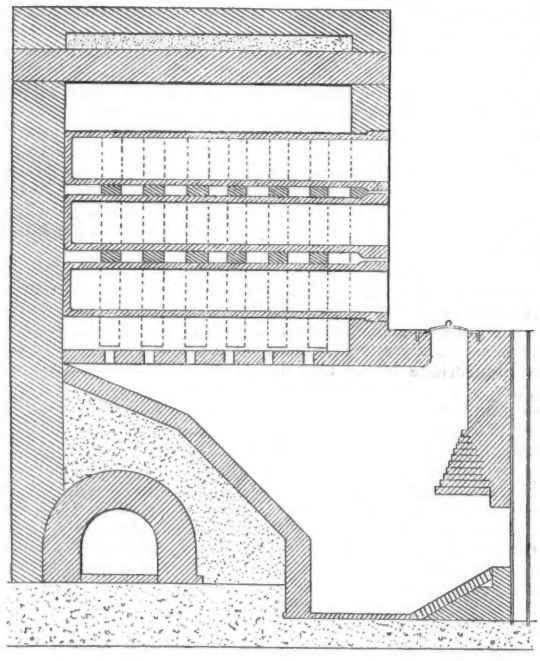
Local conditions, present and future, size of works, &c., having been duly considered, the writer advised the erection of regenerator settings of eight horizontal retorts, 22 in. by 16 in. by 10 ft., ⏀'s, with stage-floor retort-house. Four arches or beds were set in July, 1894. Two of the producers of these were arranged on the "open hearth," or ordinary system of drip-plates and fire-bars, with ash-pan underneath, and two on the closed or "solid hearth" system, with primary air-inlet and two ash-pans at the sides, as shown by the drawings—the two systems being adopted in order to decide which best suited our requirements. The arches are all of the same size—viz., 16 feet high from crown of arch to top of concrete; 8 ft. 9 in. wide between the side walls of the oven; and 10 ft. 6 in. deep from the face of the front wall to the face of the back wall—the stage-floor line being 9 feet, and the clinkering floor 18 feet from the crown of the arch. The buttress or end walls are 41 inches; the division or oven walls, 18 inches; the back of stack, 27 inches; and from the crown of the arch to the top of the retort-stack, 30 inches. The main flue is 36 inches high by 24 inches wide at the bottom of the arch.

For convenience of description, the term "open hearth" is used to indicate the settings having drip-plate fire-bars and ash-pan underneath, and "closed hearth" to mean the settings without fire-bars but with side ash-pans. The "open-hearth" producers, and the secondary and waste-gas flues, are built entirely of ordinary Stourbridge bricks and quarries or tiles, without grooves, tongues, or rebates of any description to assist in keeping the flues from bye-passing or short-circuiting. The size of the producer is 6 feet high, 2 feet wide, and 4 feet long at the bars; holding about 5 feet depth of fuel when filled. The waste-gas flues are arranged on each side of the producer and oven walls to run in double horizontal tiers, with the secondary air flue "sandwiched" between them. The producer arch runs from front to back of the setting, with two rows of secondary air and carbonic oxide nostrils, the whole length. A combustion chamber of large special arch blocks in three segments is here formed; and these, together with the two bottom retorts, which rest upon the regenerator flues, carry the 9-inch piers or walls which support the other retorts. The middle retorts are bedded immediately above the bottom ones; and the space between the crown of the bottom retort and the bed of the middle one is bricked up, with the exception of a 1½-inch space each foot run. The heat therefore rises to the top of the setting, splits at the crown of the arch, and travels down; passing away to the waste-gas flues under the bottom retorts.

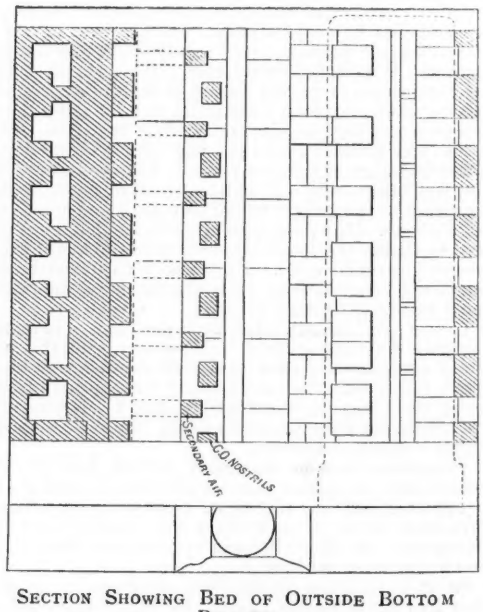
The "closed hearth" producer, and the secondary and waste-gas flues, are built entirely with special silica bricks and quarries or tiles, with grooves, tongues, and rebates, and jointed with special fire-clay cement to prevent any short-circuiting. The producer is 5 ft. 6 in. high, 2 ft. 8 in. wide, and 4 ft. long at the hearth, and holds about 4 ft. 6 in. depth of fuel when filled up. The waste-gas flues are arranged one on each side of the oven



ARRANGEMENT OF OVEN FOR STAGE SYSTEM OF RETORT-SETTING.



TRANSVERSE SECTION OF SETTING.



SECTION SHOWING BED OF OUTSIDE BOTTOM RETORTS.

wall, and run in single horizontal tiers; the secondary air-flue being formed between the waste-gas flues and the side of the producer. The area of the waste-gas flues is about 190 square inches, and that of the secondary air flues, 126 square inches. The producer arch runs from back to front of the setting, with secondary air and carbonic oxide nostrils the whole length. The combustion chamber is divided into two compartments by a 9-inch wall, which is built on the centre of the producer arch, and is carried up to support the centre middle retort; thus practically forming a double combustion chamber. The travel of the gases, and the mode of setting the retorts, are almost similar to those in the "open hearth" settings; but over the *last* waste-gas flues an ash-pan is fixed, which, being supplied with water, should form sufficient steam to make the clinker quite friable.

The above details will give some idea of the construction of the settings; but my intention is to deal more particularly with the actual experience of the two settings during the last two

years. Our make of gas is now about 31 millions per annum, with districts which are rapidly increasing in population as Greater London extends its boundary. We have an abnormal demand for coke in the neighbourhood, as it is largely used for horticultural purposes—one florist taking over 7000 tons per annum from Beckton, &c.; so that the increased amount of coke resulting from the introduction of regenerator furnaces would not in our case cause any depreciation of prices, as for some years past we have been compelled to buy large quantities of coke in order to keep our customers supplied.

On completion of the retort-beds by the contractors, a slow fire was put under two beds, one of each system, and the heat allowed to escape at sight-boxes just under the crown of the arch. After the retorts were fairly dried, it was necessary to open the dampers, and cause the heat to travel on its appointed way—a matter not so easily arranged as written about. The work, being all new, or "green," the difficulty was to get the shaft or chimney, which is 60 feet high, to induce a draught. This was accomplished by means of a steam-jet; but I was heartily glad when the shaft showed a vacuum. Though this episode is not likely to occur again with this bench, I should be pleased to hear from others as to the best and safest means of dealing with the subject.

The beds being now fairly started, one of the daily objects of a gas manager's life had to be dealt with—viz., to obtain the correct temperatures in various parts of the setting. Starting with the producer, I found most conflicting evidence as to the correct heat to be maintained to obtain a maximum production of carbonic oxide. But experience, aided by an analysis of the producer gases, soon showed that a high temperature in the producer gave the best results in the setting. Theoretically, 1100° Fahr. should give the best results; but in practice about 1800° Fahr. in the producer is necessary with us. The composition of the producer gases by volume per cent. is as follows:—

Carbonic oxide (CO)	25·70 per cent.
Marsh gas (CH_4)	2·75 ,,
Hydrogen (H)	14·06 ,,
Nitrogen (N)	52·74 ,,
Carbonic acid (CO_2)	4·75 ,,
	100·00

With the producer at this heat, the following temperatures were obtained at various points of the setting:—

Combustion chamber	2600° Fahr.
Crown of oven	2400° ,,
Entrance to regenerators	2150° ,,
Outlet of last waste-gas flue	1000° ,,

So that about 1150° are taken up by the secondary air, and in raising the necessary steam for the producers.

I anticipate that all engineers and managers will not agree as to the advisability of working at these high temperatures, from the producer to the last waste-gas flue; and although sundry professional friends have prophesied that high temperatures would not pay in the end, we still agree to differ. To my mind, the test of the whole matter lies in the results obtained—in the shape of gas made per retort in its lifetime. This is still to me an unknown quantity; inasmuch as, although we have been working over 800 days continuously with one of the beds of retorts ("closed hearth" system), it is still in good condition, and at the present moment making over 8000 cubic feet per mouthpiece in 24 hours. To put it another way, each retort has made nearly 6½ million cubic feet of gas, and carbonized about 600 tons of coal, without any repairs to the setting.

Without doubt, in the direct-firing system, a considerable amount of cutting action or local effect occurs in maintaining high heats. But in regenerator firing, this should not be noticeable; and so long as one keeps a safe distance from the melting or fusing points of fire-clay materials, there seems no reason why the materials should not wear as long as at a few hundred degrees less heat. Where the mischief undoubtedly occurs is by expansion and contraction, in letting down and firing up beds either for repairs or for the season's working.

As regards coke for fuel, it is remarkable that a coke eminently suited for direct firing was not found so suitable for regenerators; the coke most suitable being of a porous and almost spongy condition. A hard dense coke becomes coated over with ash, and prevents that entire contact with the air necessary to secure perfect combustion. The smaller the percentage of ash, the better the results obtained; but coke with even 10 per cent. of ash, so long as it is porous, will give very good results indeed.

The vacuum required depends on the nature of the fuel employed; about 2-10ths or 3-10ths of an inch generally being sufficient at the last waste-gas flue. Of course, a great deal depends upon the adjustment of the dampers, and the admission of the secondary air. A good illustration of this adjustment is seen in the ordinary brazing forge burner, where by the increase of blast or secondary air, the flame is shortened and made more intense, and by its decrease the flame is lengthened, and made less intense.

From the temperatures previously given, it will at once be seen that we do not admit a large proportion of secondary air—preferring to keep all the eight retorts at as uniform a heat as possible. The effect of a large proportion of secondary air, is to cause an intense heat in the retorts over the combustion chamber; while the two bottom retorts, and the waste-gas flues also, are rendered correspondingly dull. An average analysis of gas drawn from the last waste-gas flue will help to make matters clearer—

Carbonic oxide	00·70
Carbonic acid	16·00
Oxygen	..
Nitrogen	83·30
	100·00

Several tests, under various conditions, have been applied as to the amount of fuel used and gas made by both systems; and in all cases the "closed hearth" results are better than those obtained by the "open hearth." The following actual working results may be taken as a fair average of a series of tests made with the "closed hearth," and extending over several days:—

Number and size of retorts	8 ⏀ 22 in. by 16 in. by 10 ft.
Coal carbonized in 24 hours	6 tons 18 cwt.
Total gas made ,,	72,000 cub. ft.
Gas made per mouthpiece in 24 hours	9,000 ,,
Gas made per ton of coal ,, ,,	10,500 ,,
Coke produced	4 tons 18 cwt.
Coke used as fuel in producer	18 cwt.
Coke used per 100 lbs. of coal carbonized	13·04 lbs.
Coke used per cent. on make	18·36 p. ct.
Coke made per ton of coal carbonized	14·0 cwt.
Coke used as fuel ,, ,,	2·6 ,,
Coke saleable, without deducting fuel for boilers	11·4 ,,

The above results were obtained from unscreened Durham coals, as supplied in the South of England—coal so small as oftentimes to make one wonder if only the screenings are sent South. We have obtained better results than those quoted when pushing the settings and using a fair-sized South Yorkshire coal; but I prefer to give results which can be maintained week by week.

In addition to the above, the saving of probably the most arduous labour of a retort-house with direct firing, and certainly the most detrimental to the heat of a setting, is rendered a comparatively easy task. I refer to "clinkering"—a process performed every 24 or 48 hours, according to the percentage of ash in the coke and the temperature required in the retorts.

Here again the superiority of the "closed hearth" was easily seen; and for this to be understood it is necessary to explain that, about 18 inches from the hearth, a bridge or arch of clinker, springing from the two sides of the producer, gradually forms, and during the clinkering acts as a support to the firing in the producer. The object to be accomplished is to generate or admit just sufficient steam to reduce the ash or clinker to a friable and dusty condition. This is carefully withdrawn by a small rake, when a light steel bar breaks the supporting arch of clinker, and clears off the sides and back any which may have been too hard for the rake to remove (and which it is found an advantage to leave at the bottom of the producer for the next 24 or 48 hours). The clinkering door is then closed; the two side ash-pits cleaned out; and no further attention is required until the next occasion for clinkering. The whole operation frequently takes less time than that occupied in placing and withdrawing the false bars necessary in the "open hearth" system. Besides this, the clinker or ash does not contain any pan breeze, and can be taken direct to the clinker heap; whereas the pan breeze from the "open hearth" contains a large amount of coke which for the sake of appearance we sift and pick out, although at the present low value of coke it hardly pays for the labour bestowed on it. With the "open hearth," we find it necessary to prick up and shake the bars every few hours; otherwise the fire clinkers over, and an excess of secondary air passes through the setting, to the detriment of the heats.

The producers are filled every four hours by drawing the charge from the centre middle retort (and centre top retort, if necessary) into the producer. This also is a very easy operation, and remarkable for its simplicity. It will be noticed that the hopper which is seen under the mouthpiece of the centre middle retort, hinges and falls forward on the top producer door being opened. The shoot is placed at such an angle that the coke gravitates well to the back of the producer; and as this causes less labour than taking the coke away to the yard, the producers are always kept well filled.

In drawing, the charges are raked into iron barrows and taken direct to the other end of the retort-house, where the barrow with its charge is placed under a sprinkler, and the coke cooled. It is most important not to allow any water to be used in front of the bed; otherwise the splashes and steam make it difficult to keep the front wall air-tight, and are apt to cause fracture in the producer mountings.

The considerable saving of labour in clinkering and firing up enables a larger number of retorts to be charged per man. The average daily make of gas exceeds 30,000 cubic feet per man, in addition to the attention to the boiler and exhauster; the rate paid being 5s. per shift of twelve hours, while the average carbonizing (including yard) wages for the last six months work out under 26d. per ton of coal carbonized.

Since adopting regenerator settings, our yield of ammonia has considerably fallen, and cyanogen compounds have therefore increased. But, owing to the very low price obtained for sulphate of ammonia, the loss on the yield of ammonia has not so much affected the system as it would have done if prices had remained firmer. Against this loss there is this set-off—viz., we are being paid a small amount for each ton of coal carbonized by a firm who are supplying oxide to arrest the sulphuretted hydrogen, and especially the cyanogen compounds which are

formed with the higher temperatures obtained by regenerator firing; whereas previously we were paying for loan of oxide per ton of coal carbonized.

We also find a diminished yield of tar since using higher temperatures, which perhaps is not to be regretted, as there is no doubt that the volume of tar is reduced by converting some of the benzol and naphtha (the light oils) into a permanent gas. This is done in one operation, and seems more reasonable than the employing of another system of retorts to convert them into gas; and when we reflect that benzol is an enricher, and now worth 4s. 9d. per gallon, it behoves us to keep as much of it out of the tar-wells as possible. The tar distillers complain of the free carbon found in the pitch from our tar; and as it is interesting, samples of pitch are on the table for your inspection and criticism. This system probably furnishes another method for the self-enrichment of coal gas. I may add that it is not patented or even provisionally protected.

As regards choked or stopped ascension-pipes, we had some difficulty when first starting the regenerator system; but by even charges, steady gauge and seal or dip, and especially by using an auger or button of full size, we have not had a badly choked or stopped pipe for some months past, and I trust that such a thing will eventually become nothing but a memory.

Year.	Coals Carbonized. Tons.	Total Gas Made. Cubic Feet.	Gas Made per Ton. Cubic Feet.	Number of Consumers.
1892	2486	25,169,000	10,124	500
1893	2413	25,862,000	10,718	539
1894	2702	28,572,000	10,574	762
1895	2880	31,210,000	10,842	880

The above tabulated statement will show the progress during the last four years; and to it must be added a substantial reduction in the price of gas, from 4s. 6d. to 3s. 10d. per 1000 cubic feet, an extra 1 per cent. dividend on the original shares, and a large proportion paid off the suspense account created by building the new retort-house.

In conclusion, it will probably be noticed that any reference to patentee or contractor, or cost of settings, has been carefully avoided. The interests of the Association should prevent any paper from reading like an advertisement; but should any members desire information on these points, I shall be pleased to communicate with them privately.

Discussion.

Mr. W. E. PRICE inquired if Mr. Randall used steam underneath the bars in the open-hearth settings. He stated that he did so in the closed-hearth settings; but he did not say whether he did in the case of the open-hearth. He (the speaker) had some regenerators at work; and he had an open-hearth about 2 feet wide. The width of the producer was about 2 feet. He found that, without using steam, he had to clinker once every 24 hours; but on using steam (unfortunately not produced by the setting itself, he could not arrange for that), he could run very easily for 48 hours, and had gone as much as 60 hours. But he found the latter did not pay. It took longer to get the clinker out after 60 hours; so he returned to the 48 hours. As to maintaining the producer at a high temperature, he rather tried to do the reverse. He kept the producer at as low a temperature as possible, and allowed the temperature to increase by gaseous combustion, and not by the combustion of the coke. He also wished to ask if Mr. Randall had good heats in his bottom retorts—whether he had as good heats there as in his middle retorts; and also if his main flue was red hot. In the case of his (Mr. Price's) flue, it was just perceptibly red hot. His bottom retorts would certainly not take the same amount of coal that the other retorts did; but he found it was best to work in that way rather than raise the temperature of the settings, and increase the wear and tear.

Mr. W. H. Y. WEBBER (London), on invitation by the President, said, as he was called upon to speak on this subject, he did so the more willingly, as far as he was personally concerned, because gaseous firing for retort-settings was an old sweetheart of his; and he had watched the progress of it during the last eighteen years (he thought it was, since it was practically introduced into this country), with considerable, constant, and special interest. He would wish to begin by complimenting the author on the clear way in which he had proposed the questions for settlement by experience. He had gone quite the right way to work, as if it were a new thing altogether—putting the two different kinds of producers side by side, and watching the results. In the absence of the drawings, he (Mr. Webber) could not follow the distinctions between the two settings quite so clearly as he should be able to do when he had the drawings in his hand. To some extent the paper recalled the old controversy in which some of those present took part; and he was sorry that one gentleman who had joined in it was not now present. He referred to Mr. Carpenter, who would have been able, no doubt, to have contributed very considerably to their knowledge on the subject. It was largely owing to him that the exaggerated claims for the advantages of regenerative furnaces which were in the early days imposed upon them by their German brethren, were exposed and practically abandoned. He (Mr. Webber) noticed in the paper a little recrudescence of some of the German ideas of a dozen years ago. He saw Mr. Randall said in one part of the paper that "over the last waste-gas flues an ash-pan is fixed, which, being supplied with water, should form sufficient steam to make the clinker friable." The author laid considerable emphasis on the word "should;" but he (Mr. Webber) could not see in the paper any remark as to whether it did or not. The idea of making the steam with the waste-gas flues was a very familiar German fad. They went to a large expense in trying to do it; but he did not think anyone succeeded. When they could get steam, as much as was wanted, in proper proportion and pressure, with a breeze-fired boiler, it was not worth bothering about it. The question of keeping the clinker friable in the fire was the *crux* of the matter when gaseous firing was first introduced. Some of those who worked it in the early days—himself among the number—found considerable difficulty from the clinker, which took the form of an arch, and stopped the draught. It seemed to him rather peculiar that the formation of an arch of clinker was put forward in one place in the paper as one of the advantages of working the producer. With regard to the carbonizing figures, was it to be understood that all these were actually ascertained by weighing? [Mr. RANDALL: Yes.] They all knew there had been any amount of controversy over the proportions of coke used for fuel, and the coke made, &c.; but it had so often happened, in some favourable figures that had been put forward, that, on the question being pushed home, one quantity (which generally was the make of coke per ton of coal carbonized) had been assumed. If Mr. Randall could assure them that these things had been precisely weighed, it would tend to fix their ideas much more on the subject than would otherwise be the case. He (Mr. Webber) was pleased to find the "cause" going on, and that these various little points of working were being taken up and thoroughly explored. Mr. Randall seemed to have done his work very completely indeed; and he had no doubt he would meet his reward. He did not agree with the opinion that it was absolutely necessary to work a producer very hot; he could not see where the advantage of doing so came in. Mr. Randall thought it was best for him; but he (the speaker) rather agreed with Mr. Price. He thought if the producer could be worked at a more reasonable heat, there were advantages on that side. At all events, Mr. Randall seemed to have got things very hot here; and some of the results of this were peculiar. Pitch seemed to be a vanishing quantity altogether. It became converted into coke. There was a curious passage in the paper which seemed to him like a slight confusion of reasoning; but no doubt Mr. Randall would be able to remove it. He said: "When we reflect that benzol is an enricher, and now worth 4s. 9d. per gallon, it behoves us to keep as much of it out of the tar-wells as possible." Was it worth 4s. 9d. as an enricher, or to sell? because, if this was the market price, they would want to get it into the tar-well and sell it. An enricher could be obtained at something less than 4s. 9d. a gallon. There was one other point, with reference to the author's statement about the temperature obtained at various points in the setting. He said: "About 1150° are taken up by the secondary air, and in raising steam for the producers." He (Mr. Webber) did not think this quite necessarily followed. Because a certain amount of the temperature disappeared somewhere, it did not follow they had got it all in the secondary air. There was such a thing as conduction; and he thought there should be some positive proof that the 1150° did go into the secondary air and raise the necessary steam for the producer. He thought Mr. Carpenter would have come down very heavily on this point had he been present.

The PRESIDENT suggested that perhaps some of the members who had not had experience of regenerators had employed generator furnaces; and they might discuss the question as to the comparative economy of the two systems.

Mr. D. H. HELPS (Croydon) asked if Mr. Randall had much difficulty in getting the tar from the hydraulic mains. He seemed to have a large amount of carbon in the tar which must of necessity thicken it. At Croydon, they had two types of regenerator settings; and if they ran the heats to anything like the extent mentioned by Mr. Randall, they would get choked up in the hydraulics.

Mr. PRICE said he should like to add a few remarks with reference to generator firing. He had both systems at work at the present time; and he found that the amount of coke used in the regenerator settings would be about 13 per cent. per 100 lbs. of coal carbonized, while the generators worked out to about 16 per cent. Of course, the generators were not to be compared with the regenerators in any way; but they were decidedly much better than direct firing. Perhaps he might be allowed to mention that he used a modification of the generator which he thought was a sort of compromise between direct firing and the regenerator. By the method of going down about 18 inches or 2 feet only, he was able to introduce two great advantages of this method of firing—that was, the drip-plates and the false bars for clinkering; simply attaching them to the ordinary direct fire. By these means, he could clinker once in 24, instead of every 12 hours. He had enough fuel left on the false bars to prevent the entry of cold air into the setting. As he had said, he went down 18 inches; and the plates covering the opening formed the door to the fires. In these plates, he had a certain number of holes; and, by means of plugs, he could readily regulate the air supply.

Mr. R. HERRING (Dover) remarked that one point which occurred to him was that the draught Mr. Randall used in his settings was altogether opposed to what would be conducive to economical results. It was much more than in ordinary settings;

and this suggested to him the question whether Mr. Randall got into any trouble with his regenerators.

The PRESIDENT said the great point to be considered in these matters was the comparative economy—whether the greater expenditure for a setting of this sort was compensated by the saving which, theoretically, should be effected by regeneration. He should be sorry to say that such a saving was not to be effected; and Mr. Price, who had tried the two systems, told them his results. That there was a difference, no one would deny; but such a setting as the one described by Mr. Randall must represent a considerable outlay, as compared with the generator furnace arrangement. He (the President) had never worked with regenerators; all his furnaces being now on the generator system. Mr. Carpenter's name had been mentioned; and they knew that some years ago he gave them an interesting comparison between gaseous firing on the generator system pure and simple and the regenerator system, in which the secondary air was heated by the waste gases leaving the setting. So far as he (the President) had interested himself in the controversy, he should imagine the furnace which Mr. Randall had brought before them was an efficient one of its kind. The area seemed to be amply sufficient The depth of the fuel was somewhat small; but perhaps this was owing to local difficulties. He thought, if he appreciated the drawing, that the depth of the furnace could be increased by perhaps 2 feet. He should have thought it would have been desirable to have had a greater depth of fuel where it could be arranged. In the ordinary generator furnaces in London, in stage retort-houses, the depth of the fuel he imagined was not less as a rule than 7 feet from the fire-bars. Mr. Randall had given them some interesting figures in regard to the temperatures of the various parts of the settings, and the analysis of his fuel gas and the products of combustion. So far as his (the President's) memory went, these compared very favourably with the published results. With regard to the temperatures, they were very considerable; but he thought all would agree with him that the temperature of the combustion in the various parts of the setting must not be taken to be the temperature at which the coal was carbonized. As to the vacuum, Mr. Herring had drawn attention to that. Then Mr. Randall said that a great deal depended upon the admission of the secondary air—the effect of a large proportion of secondary air being to cause an intense heat in the retorts over the combustion chamber. Now he (the President) could not agree with this. It would depend largely on the way in which the fuel gas was distributed along the base-line of the setting; and because they introduced four times as much nitrogen as oxygen, the larger the amount of the secondary air introduced above what was theoretically necessary, the lower would be the temperature throughout the setting. They must always take in more than theory required. The cutting action, or intense local heating, was due to insufficient spreading of the fuel throughout the bed. The author had not given what he believed to be the heat of his retorts. But he should imagine that his high heats were regularly maintained; and therefore that, though they were high, they were followed by a regular and even production of gas, without causing trouble by stopped pipes. He did not think, if the stopped pipes were few in number, that he would be troubled with deposits of thick tar in his hydraulic main. With Mr. Webber, he should also like Mr. Randall in his reply to be more precise as to the question of the weighing of the fuel. It must be made quite clear, he thought, that this was the record of actual experiment, in which the coal was weighed into the retorts, and the coke into the furnace. He imagined that Mr. Randall would be able to tell them this was so; and he (the President) was going on the assumption that, in regard to the remarks Mr. Price had made, he had also done the same. Anything less was of no real scientific value, although, of course, if the sale of coke per ton of coal carbonized came to considerably more, there was satisfactory proof that less coke was being used in the furnaces. Mr. Randall stated that he found a "diminished yield of tar since using higher temperatures, which perhaps is not to be regretted, as there is no doubt that the volume of tar is reduced by converting some of the benzol and naphtha (light oils) into permanent gas." He was not surprised to hear there was a diminished yield of tar; but he could not agree with the author that the result was that the benzol remained in the gas as benzol. The mere fact of the yield of tar being reduced would prove to his mind that there was less benzol in the gas than before. It was a question which, he supposed, could only be determined by the photometer; and perhaps Mr. Randall would take them into his confidence, and say whether the illuminating power of the gas had improved since the introduction of this regenerative system. It went without saying that high heats meant the breaking up of the benzol into other products which were of less value. Mr. Randall had made a clear statement of the amount of coke which was to be procured from a ton of Durham coal—viz., 14 cwt.; and he managed to sell all round 11·4 cwt. per ton of coal. He thought it must be admitted that, at all events in this respect, Mr. Randall had lost nothing by the introduction of the regenerator furnaces, though he should hardly like to go so far as to say that the extra amount of coke saved by the adoption of regenerators rather than generators would compensate him for the largely increased cost which must have accompanied the erection of these elaborate settings. He would say again that, from his recollection of the old controversy, these settings were good types of regenerators. They were of ample area throughout the waste flues, secondary flues, and so on.

Mr. E. C. RILEY (Swindon) pointed out that nothing had been said about the question of cost in the paper; and perhaps Mr. Randall would tell them how the cost of this regenerator setting compared with the cost of a direct-fired setting. At his works, with ordinary settings, they made about 150 million cubic feet of gas; produced about 30,000 cubic feet per man; the cost of carbonizing was 2d. to 2½d.; the yield 5000 feet per mouthpiece; and the fuel consumption about 20 to 23 per cent. Mr. Randall's make per mouthpiece was an important matter; and if the cost of the setting was not great, it would strengthen the gas manager who wished to move in the right direction to the economical production of gas.

Mr. RANDALL, having thanked the several speakers for their criticisms, said that, of course, they all understood that this was a subject that had many side issues. Mr. Price mentioned the question of the use of steam under the bars. As Mr. Price knew, the water trickling down the bars caused steam, and that which was not converted into steam remained in the ash-pit, and was still of help. Then Mr. Price was rather labouring under a misconception in imagining that the high temperatures in the producer were obtained by gaseous combustion. It was not so at all. If he obtained these high temperatures in the producer by gaseous combustion, his analysis would very soon show it to be so; and if Mr. Price looked at the analysis, he would see that it was not as he supposed. In the bottom retorts, he did not get quite so good a heat. The secondary air was restricted, so that they were able to obtain as uniform a heat as was possible throughout the setting, including the two bottom retorts. The main flue temperature was very similar to that mentioned by Mr. Price—it was just a faint blood red. He (Mr. Randall) was very thankful to Mr. Webber for his remarks, coming as they did from a gentleman of such great experience on the subject. It was quite true he (Mr. Randall) did say "*should* form sufficient steam," because the patentee of the settings declared that it was possible for it to be effected by the waste gases only. Regarding the arch of clinker, that was most important—he might say imperative—for this reason: That without the arch forming from side to side, it was impossible to clinker. It must be understood that no bars whatever were used in clinkering; and this arch sustained and held the fire up during the operation. They had simply to draw the friable ash from underneath the arch, then give it a tap, and the superimposed fire fell down. The light steel bar mentioned was only about ⅜-inch diameter; so that it would be clearly understood that they were not troubled with clinker in the ordinarily accepted sense of the term. The question of weights was, of course, most important; and any figures given without very careful details would, he admitted, be valueless. For purposes other than the paper, he had to take a great deal of trouble in this respect. He said "trouble;" and it was so at the time, because he spent upwards of 48 hours in weighing and getting the results tabulated in the paper. The way he did it was this: He numbered the retorts. Then, as they were charged, the time was put down, and the number of the retort. The amount of coke drawn from it was weighed red hot, including the barrow, for gross, the tare of the barrow was taken off, and this gave him the actual net amount of coke. Whether it was deposited in the producer or in the yard, it was taken for 48 hours right through. Every charge was weighed into the retorts, because they used a single scoop, so that they could weigh up to exactly a pound, and know precisely what was being done. The tests were carried out as carefully as would have been done in the laboratory. The whole of the results were tabulated, and the totals taken out; and the copy he had given in the paper was the total result of the whole setting. He therefore thought the members would agree with him that every care was taken to get definite figures. The next point was the very hot producer; and unless he had a hot producer, he would not get the charges well burnt off, as had to be done, in four hours. With small Durham coal, in the very fine state in which he received it, it was absolutely necessary that they should have the very best setting for dealing with it. The draught of 2·10ths or 3·10ths of an inch was found successful. If the producer was not hot, the setting corresponded; and a dull producer meant a dull setting. The price of 4s. 9d. which he quoted for benzol, he introduced particularly for the purpose of producing discussion. What he meant was this—that, although this benzol was used as an enricher, the tar distillers did not give small gas companies an increased price according to the amount of benzol and its value. And it occurred to him that, if they could obtain—and they undoubtedly did obtain—a greater illuminating power by using high heats, instead of letting the tar distillers take the benzol away (which in many cases was brought back to them at ridiculous prices), it was their duty to themselves and their companies to get as much of it as they could into the gas, to increase the illuminating power. Regarding the 1150° taken up by the secondary air and in raising the necessary steam for the producers, it would be clearly seen where he obtained these figures. It was merely a question of subtraction. Certainly some of the heat was absorbed by conductivity. It would be noticed that the temperature at the entrance to the regenerators was 2150°, and at the outlet of the last waste-gas-flue 1000°; so that the difference was 1150°. He took this as a means of giving them an idea of the value of

raising the secondary air to this temperature. The President had asked as to a comparison of the fuel used with generator firing. His (Mr. Randall's) figures compared with those given by Mr. Price—16 or 17 per cent. It must be borne in mind that with high heats they did not use so large a quantity of coal. It would be seen by "Field's Analysis" that frequently under 10,000 cubic feet of gas was produced per ton of coal. Of course, if they only obtained this production, a much larger quantity of coal was used; and if they put in so much more coal, it caused a corresponding increase in the yield of coke and a decrease in the percentage of fuel used. This must be borne in mind in making this criticism. With the regenerators, they were able to get the large make of 9000 cubic feet per retort. Mr. Douglas Helps had asked about the tar in the hydraulic main. The piece of tar he had there was not obtained directly from the hydraulic; it was received from the tar distillers. In the first instance, it partly came from the hydraulic main into the tar-well. If it were in the state Mr. Helps imagined it to be, certainly they would have a lot of stopped pipes. They had had a patented arrangement of valves, by which the tar was taken out from underneath the hydraulic; and they were continually bothered by stopped pipes. They were now working simply over the weir valve; and the tar was taken away immediately after passing the weir valve. As to the question of the cost of the settings, that, of course, depended upon many circumstances—such, for instance, as the locality in which they were erected.

On the proposition of Mr. MAY, seconded by Mr. HUMPHRYS a hearty vote of thanks was passed to Messrs. Price and Randall for their papers.

This concluded the business on the *agenda*; and immediately afterwards the members took tea together in an adjoining room.

TRIALS OF GAS-STOVES.

The following is a summary of the more important results of a number of trials of heating with gas-stoves, of which very voluminous reports have recently been published by Professor A. von Ihering, of the Imperial Technical High School at Aix-la-Chapelle, in the "Journal für Gasbeleuchtung."

A room having an air space of about 3170 cubic feet was chosen for the trials. The walls were exposed on the south and west, and on the east only abutted on the hall and staircase, so that the loss of heat through them was relatively great. Eight different makes of stoves, sent out as suitable for heating a room of the above capacity, were used; and the trials were directed specially to the following points: (1) The consumption of gas needed to make the room warm; (2) the consumption of gas needed to maintain it at a given temperature; (3) the composition of the gas; (4) the temperature of the exit gases; (5) the loss of heat in the exit gases, or the utilization of the heat generated in the stove; (6) the heating value of the gas used; (7) the amount of carbonic acid in the air; (8) the temperature of the room at different points, and (9) the mean temperature; (10) the degree of moistness of the air; and (11) the relative quantities of heat radiated from the reflectors.

The stove on trial was placed in the middle of the east side of the room—beneath the mouth of the chimney—and the gas-meter in the north-east corner of the room. The outlet-pipe was forked, so as to admit of the introduction of a temperature regulator in one branch. The two branches were furnished with stopcocks; the main tap being placed on the inlet to the meter. A fourth stopcock was provided on the pipe, close to the stove itself. By this arrangement, it was possible to work either with or without the temperature regulator. The main tap was only used in the trials made on all the stoves at a fixed consumption of gas. The products of combustion were conveyed to the chimney by a pipe 3¼ inches internal diameter, and about 6 feet in length, with which a tight joint was made to the stove. A hole was bored in the pipe 8 inches above this joint for the insertion of a cork through which a thermometer was passed, so that its bulb reached to the middle of the pipe. Opposite the thermometer, the pipe was bored, and a tube fixed in it for the withdrawal of samples of the hot gas. A Böhm temperature regulator was used. Its action depends on the partial closing of a valve set in the supply-pipe, by the extension of a spring, which is very sensitive to small changes of temperature. The temperature was taken by nineteen thermometers, of which six were on the floor-level, four in the corners of the room, and one in the middle of the east, and one in the middle of the west wall. Six were placed 5 ft. 2 in. above the floor; and six more above them and close to the ceiling (9½ feet from the floor). The three thermometers of each set were in a vertical line. One thermometer was suspended at a height of 5 feet in the middle of the room. These nineteen thermometers were read hourly, as were also one in the middle of the room adjoining the experimental room on its north side, one on the staircase, one in the room below, one in the room above the experimental room, and one placed outside the window of the room on the north side. The latter served to give the temperature of the outer air; but its readings were compared with the various temperatures recorded at the local meteorological office. This office was at the same altitude, and only 100 yards distant; so the barometer readings taken there sufficed.

The spent gases were analyzed in an Orsat's apparatus; and two or three analyses were made for each trial. The temperature of the spent gases was read each time. To ascertain the excess of air, the free oxygen was determined as well as the carbonic acid. Carbonic oxide could only be detected by the palladium paper reaction either in the exit gases or the air of the room. The carbonic acid in the latter was determined by aspirating 10 litres of air through a weighed caustic soda tube protected by calcium chloride. The sample of air was drawn at a height of about 32 inches, and at about 20 inches from one side of the stove. To ascertain if the air of the room was rendered more dry or more humid by the gas-fire, hygrometers were suspended half way up the walls on the west and east sides of the room. In order to draw conclusions as to the degree of perfection of the construction of the reflectors, it appeared desirable to estimate the heat radiated from them. For this purpose readings were made at nine places in the plane of radiation of the stove with a thermopile and galvanometer. An attempt to ascertain the absolute value of the heat radiated, by means of a calorimeter coated with lampblack, was not successful, as heat rays issued not only vertically to the plane of emission but also obliquely, and the latter did not strike the calorimeter.

It was desired to make an extended trial of each stove, as well as the ordinary day trials; but this could not be carried out with all the stoves, owing to the room being needed for other purposes. The time and consumption of gas required to raise the room to 68° Fahr. were first ascertained, and then the gas consumption necessary to maintain the temperature. On the following day, after raising the room to the above temperature, the gas consumption was set at 17·6 cubic feet per hour, and the trial continued for seven hours. In some cases, a continuous trial lasting one week, with the temperature regulator in action, was made. The weather was for the most part very unfavourable to the trials; and the temperature outside was very seldom below freezing-point. The house in which was the experimental room had been uninhabited prior to the trials; and a gas-stove was therefore kept burning in that room for 17 days before the trials were begun. At the close of each day's trial, the doors of the room were opened, so that by the following morning the room had attained the temperature of the rest of the house, which remained almost constantly between 41° and 43° Fahr.

The heating value of the town gas was ascertained both calorimetrically and by calculation from its composition. Thirteen determinations by Junker's calorimeter gave a mean value of 155·8 calories per cubic foot. To calculate the heating value of the gas from its composition by Slaby's formula, the density of the unsaturated hydrocarbons in it must be known; and to find this, the specific gravity of the gas was determined before and after their removal by fuming sulphuric acid. The mean of twelve analyses of the gas showed its percentage composition to be—

Hydrogen.	Methane.	Carbonic Oxide.	Hydrocarbons.	Nitrogen.	Carbonic Acid.	Total.
54·0 ..	34·2 ..	5·2 .	3·3 ..	2·2 ..	1·1 ..	100.

The mean specific gravity by Schilling's effusion apparatus was 0·3826. From the above and other calorimetric determinations, and from the values calculated from the analyses, it was found that the mean calorific value of the gas was 155·7 calories, taking the water formed as liquid.

The quantity of air needed for the combustion of the gas, and the volume of the products were calculated. One part by weight of each of the following gases requires the stated parts by weight of air for its combustion:—

	Hydrogen.	Unsaturated Hydrocarbons.	Methane.	Carbonic Oxide.
Air needed. .	34·39 ..	14·667 ..	17·11 ..	2·457

From these data, the gas in question was found to require 5·466 times its volume at 15° C. and 760 mm., or 5·1816 times its volume at 0° C. and 760 mm. It yielded 6·201 times its volume of products of combustion at 15° C.; and their percentage composition was: Carbonic acid, 8·392; aqueous vapour, 21·597; nitrogen, 70·011. The volume of gas and air together was 6·466; and therefore the contraction on combustion amounted to 0·265 or 4·1 per cent. of the original volume. The next table shows the percentage composition of the products of combustion with different proportions of air:—

Volumes of Air in Terms of the Theoretical Quantity needed.	1	1·3	2	3	4
Carbonic acid .	8·392	5·825	4·461	3·038	2·304
Aqueous vapour.	21·597	14·993	11·480	7·829	5·928
Nitrogen . . .	70·011	72·728	74·170	75·685	76·460
Oxygen . . .	—	6·452	9·880	13·463	15·310

The general equation for calculating the quantity of air from the proportion of carbonic acid in the products of combustion was deduced. If a = the percentage by volume of carbonic

Makers of Stove.	Corrected Consumption in Cubic Feet per Hour.		Temperature of the Rooms in Degrees Fahr.		Volumes of Air Used in Terms of the Volume Theoretically Necessary.	Heat Developed per Hour in Calories.		Heat Developed.	
	In Attaining the Desired Temperature.	In Maintaining that Temperature.	Before the Trial.	Mean Temperature Maintained.		In Attaining the Desired Temperature.	In Maintaining that Temperature.	Percentage Lost in Exit Gases.	Percentage Rendered Available.
Warstein Foundry	31·9	17·8	43·3	57·2	2·842	4433	2471	11·00	89·00
R. Kutscher, of Leipsic . . .	41·7	23·7	41·9	60·8	5·890	5788	3285	18·10	81·90
J. G. Houben, of Aix-la-Chapelle.	33·7	29·4	41·9	66·2	5·155	4671	4076	29·20	70·80
F. Graf, do.	26·0	17·2	41·5	57·7	4·628	3600	2389	8·00	92·00
Schäffer and Walcker, of Berlin .	33·0	24·7	40·8	58·8	4·195	4586	3424	24·40	75·60
A. Michel, of Aix-la-Chapelle . .	29·1	22·6	43·3	59·4	3·676	4041	3132	18·40	81·60
German Continental Gas Co. . .	29·9	22·5	43·2	59·0	3·670	4153	3128	12·50	87·50
F. Siemens, of Dresden . . .	..	13·4	..	64·4	1·986	..	1858	4·32	95·68

acid, and m = the multiple of the theoretical volume of air required, then

$$m = \frac{49{\cdot}36 - 5{\cdot}8819a}{5{\cdot}1816a} + 1$$

The quantities of air for all the trials were deduced by aid of this equation. The value of m thus found permits of the volume of the exit gases at the temperature at which they leave the stove being readily deduced. With m times the theoretical quantity of air required for x volumes of gas burnt per hour, and with the exit gases at $t°$ C., and the barometer standing at b mm., the volume of exit gases per hour would be—

$$= (0{\cdot}739 + 5{\cdot}466m)\, x\, \frac{760}{b} \cdot \frac{273 + t}{288}$$

The volumes of exit gases for all the trials were deduced from this equation.

The specific heats for a temperature of 100° C. are, according to Slaby: For carbonic acid, 0·216; for aqueous vapour, 0·459; and for nitrogen, 0·247. These values, with the proportions by weight of the respective gases found in the exit gas from the combustion with the theoretical quantity of air, show a loss of 5·55 calories in the exit gases from the combustion of 1 cubic foot of gas for a difference of 100° C. between their temperature and the temperature of the room. But a cubic foot of gas develops 155·7 calories. The latent heat or heat of vaporization of water amounts, however, to about 17 calories; and hence the calorific value of a cubic foot of the gas, supposing the water formed by combustion remains as steam, is only 155·7 − 17·0 = 138·7. The loss of heat through the exit gases is, therefore, equal to $\frac{5{\cdot}55 \times 100}{138{\cdot}7}$ or 4·0 per cent. of the total available heat of the gas. With m times the quantity of air theoretically required for the combustion, the heat lost through the excess of air is 4·51 $(m - 1)$ calories per cubic foot of gas consumed for a difference of temperature of 100° C.; and the total quantity of heat lost per hour becomes $= 5{\cdot}55 + 4{\cdot}51\,(m - 1) = 4{\cdot}51m + 1{\cdot}04$, or for every degree difference between the temperature of the exit gases and that of the air of the room the loss of heat per cubic foot of gas burnt is equal to $0{\cdot}0451m + 0{\cdot}0104$ calories. By the aid of this factor, the loss of heat for any given consumption of gas, and any difference in the temperature of the air and exit gases, is readily calculated.

The results of the more important trials are given in the foregoing table, which is compiled from the immense mass of figures given by Professor von Ihering. The examples have been selected with a view to giving a fair impression of the general efficiency of heating by gas; and they are not necessarily indicative of the relative merits of the different makes of stove. Experiments were made with Michel's stove on the influence of the size of the exit-flue. Screens or dampers fitting the pipe closely, and each having a circular hole of known diameter, were inserted in turn at the base of the pipe. The greatest efficiency was found when the orifice was only 0·79 inch in diameter. The heat lost in the exit gases was then only from 3 to 5 per cent. of that developed; and this result appeared to be due to a reduction of the excess of air, brought about by the contraction of the flue. The efficiency increased with a diminution of the gas consumption. The Dessau and Siemens' stoves showed similar results when the regulating-flap in the exit-pipe was partially shut so as to contract the outlet to about 0·79 inch. It appears that, by selecting an exit-pipe of suitable diameter, the efficiency of the stoves can be raised from 80 to 96 or 97 per cent. A low temperature of the exit gases is found with the Graf stove. This is in part due to a narrow outlet, and in part to a water-cooler which enters into its construction. The water began to boil within a quarter of an hour of the lighting of the stove, and continued in a state of noisy ebullition, while the humidity of the atmosphere became so great that water condensed on the walls, &c., and the trial had to be broken off.

On comparing the transmission of heat by the walls with figures obtained by the use of the generally recognized coefficients for the various materials, it was found that nearly one and a half times the calculated amount of heat was actually transmitted. It appeared the coefficients were too low—especially for outer walls, and the coefficient for heat transmission should be about 50 per cent. higher for new buildings than for old ones which have been inhabited for a long period.

With regard to the amount of carbonic acid present in the air of the room, it is to be observed that the room was ventilated through the doors only, and that windows were not opened during the continuance of the trials. Consequently air containing much carbonic acid may have remained near the floor of the room. The samples of air for examination were taken at a height of 32 inches; and there were found from 2·85 to 7·16 parts per 1000 of carbonic acid.

The experiments on the radiating efficiency of the reflectors showed that the radiant heat increased with the consumption, and also increased with a diminution of the exit-pipe. The Warstein stove appeared to have the most efficient reflectors, and next in order came the Michel and the Siemens. With these two, the radiation from the lower part of the reflectors was far greater than from the upper.

Mattoni's Hydrated Ferric Oxide.—This material has achieved considerable success as a purifying agent in Continental gas-works. It is put on the market by a Frauzensbad (Bohemia) firm, and is a natural product. It is said to be much superior to ordinary bog oxide, as it is naturally very porous, and needs no preliminary preparation or admixture of sawdust. Its revivification is rapid and thorough.

A New Incandescent Gas Mantle invented by Mr. J. Lery, of New York, is constructed from threads composed of a solution of nitro-cellulose, containing the substances which are intended, upon being exposed to the flame of the lamp, to produce incandescence. It is claimed that these mantles are more flexible, more resisting in use, and have a higher lighting effect than those now upon the market.

Fuel Gas Supply for New York.—Some time ago, a petition was presented to the New York Corporation, by the Consumers' Fuel Gas Heat and Power Company, for authority to lay gas-mains under the streets of the city, to furnish fuel gas for commercial purposes. The Company offered at first to supply fuel gas at a mixmum price of 50c. per 1000 cubic feet, and to pay the city the sum of 30c. per lineal foot of pipe laid. Several competing companies, it is reported, made application for consideration; but the Corporation felt that the Consumers' Company—the first applicants—were entitled to the franchise, the more so, indeed, as it had been rumoured that a combination of the competing companies had been formed to defeat the Consumers' Company, and secure the franchise for themselves, but with the intent of not using it. The question of the right of the Corporation to confer the franchise at all was referred to their Counsel, who has expressed the opinion that the Legislature has not invested the Corporation with power to grant the application. He holds that the acquiescence of the property holders along the route of the proposed mains is a condition precedent to sanction of the Company's proposal.

Photographing the Flash in Explosions of Mixed Gases.—At the recent meeting of the British Association, Professor H. B. Dixon, F.R.S., read, before the Chemical Section, a paper on "Reflected Waves in the Explosion of Gases," in the preparation of which he had been assisted by Messrs. E. H. Strange and E. Graham. Its chief interest consisted in the evidence it afforded of the existence of a reflected wave, travelling along the glass tube in the opposite direction to the flash and at a slower rate, and the calculations based upon its velocity. The rate of propagation of the explosion is ascertained by photographing the flash as it passes along the tube, on a revolving, sensitive film, and measuring the angle through which the image has turned. Experimenting with different mixtures of carbonic oxide, &c., maximum temperatures between 3000° and 4000° Fahr. were calculated. These temperatures would be of the same order as those found by Bunsen, Berthelot, and Mallard and Le Chatelier, for the temperature of the explosion. Pressures like those observed could be measured, while the actual explosive impulse is too fugitive to allow of measurement. The reflected wave is characterized by a certain luminosity. Sir G. Stokes expressed the opinion that this might be due, not to chemical action, but to the temporary compression of the gases already heated to nearly the point of luminosity.

AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting at St. Louis (Mo.).

The Twenty-fourth Annual Meeting of the above-named Association was held in the Planters' Hotel, St. Louis, on the 27th, 28th, and 29th ult., under the presidency of Mr. C. J. Russell Humphreys, of Lawrence. The proceedings opened with the reading by the Secretary (Mr. A. B. Slater, jun., of Providence) of the report of the Council on the admission of new members. It showed that applications had been received from twenty-three gentlemen desirous of being active members of the Association, from nine who wished to join as associates, and from two seeking transfer. These applications received the approval of the meeting. Next came the report of the Council on the Management of the Association. It stated, among other things, that the First Vice-President (Mr. Irvin Butterworth) had tendered his resignation, which had been accepted after consultation with him. The Council thought they expressed the sentiments of the Association in communicating to Mr. Butterworth their regret that he should have deemed such resignation advisable. They recommended for election to honorary membership Mr. Forrest E. Barker, a member of the Board of Gas and Electric Light Commissioners of Massachusetts; and they nominated the President to represent the Association at the gas exhibition to be opened in New York early next year, as already mentioned in our columns. The report was adopted. Mr. Barker was subsequently introduced to the meeting, and acknowledged the honour conferred on him. The Secretary's report, which was next presented, showed that the total number of members on Sept. 30 was 429; and the statement by the Treasurer, which followed, revealed the gratifying fact that there was in hand at that date a balance of $478·51. Next came the report of the Committee on Education and Research, which stated that 76 students had joined the instruction class during the year; and after it the report of the Committee on Standards, which was read by Mr. Butterworth. The Committee had not been able to go very exhaustively into the subject assigned to them. They found that the putting into practical use by gas companies of such standards as had already been adopted by the Association, had not been sufficiently general to encourage the belief that any further standards would be adopted, except for purposes of discussion and comparison, and as a basis from which to work in making plans or drawing up specifications. They nevertheless suggested that further consideration of the subject should be referred to the Committee on Research; and they set forth the matters which they thought might be reported upon. The Committee were discharged, and the subject was passed over to the Education and Research Committee. The election of office-bearers for the current year then took place; the following gentlemen being chosen:—

President.—C. H. Nettleton, of Derby (Conn.).

First Vice-President.—J. B. Crockett, of San Francisco.

Second Vice-President.—A. C. Humphreys, of New York.

Third Vice-President.—G. G. Ramsdell, of Philadelphia (Pa.).

Secretary and Treasurer.—A. E. Forstall, of Newark (N.J.).

The President then delivered his Inaugural Address, which was well received. The afternoon of the first day was principally occupied with the reading and discussion of an excellent paper by Mr. C. H. Nettleton, entitled "A Discussion on the Methods Employed in Introducing Gas-Stoves." The other papers submitted to the meeting were: "Inclined Retorts up to Date," by Mr. F. Egner; "A Modern Retort-House," by Mr. W. S. Miller; "The Separation of Water-Gas Tar," by Mr. A. S. Miller; and "Some Experiments in Interior Illumination," by Mr. C. H. Page, jun. The papers by Mr. Miller and Mr. Egner were given in the "JOURNAL" last week (pp. 902, 904). The President's Address and the remaining papers, with the discussions, will be dealt with in our usual abstract of the report of the proceedings as given in the "American Gaslight Journal," from the last number of which the foregoing preliminary particulars have been obtained.

The Electric Industry in the United States.—Writing in "Cassier's Magazine" for the current month, Mr. W. Baxter, jun., gives some particulars as to the electric industry in the United States. According to him, in the field of lighting, the total capital invested is more than $500,000,000; and the number of plants, public and private, is upwards of 10,000. The number of motors in use is estimated at about 500,000; and their value at $100,000,000. The electrical apparatus used in mining is reckoned at $100,000,000; and the value of the electric elevator industry will probably not fall short of $15,000,000. The most important of all the electrical industries, however, is that of railways. In this field the investment is very great; and in the United States, it is represented by a capitalization of more than $700,000,000. The aggregate of all the capital sunk in electric lighting, railways, and power, is about $1,500,000,000, exclusive of the value of the establishments that manufacture the machinery and apparatus. It would therefore not be extravagant to estimate the total investment in every department of the electrical industry at $2,000,000,000.

REGISTER OF PATENTS.

Generating Gas for Artificial Lighting and Motive Power.—Devis, A., of Charleroi, Belgium. No. 19,830; Oct. 22, 1895.

This invention refers to "the automatic production of gas or vapour from cold oxygenated petroleum, by injection or insufflation of compressed air into either ordinary petroleum (commonly called lampant oil), into any other rich mineral oil."

The apparatus consists of a receiver containing trays (communicating with one another) for petroleum, or any other rich mineral oil. These are intended to receive air under pressure, which saturates it until it becomes a gas. This gas passes through a cotton bed to purify it, and afterwards enters a dome above the petroleum trays. In combination with the apparatus, there is a dome for forcing compressed air into the trays; the dome working in a receiver provided with two pistons, connected at the upper end of their rods to the crown of the dome, and forced upwards by water pressure in such manner as to carry the dome with them. The latter during its ascent sucks air by a valve with which it is provided on the top, and which closes automatically at the same time as the water-escape tap opens.

Material for Purifying Water, Sewage Effluents, Illuminating Gas, &c.—M'Donald, G., of 7, Quality Court, Chancery Lane, E.C. No. 19,952; Oct. 23, 1895.

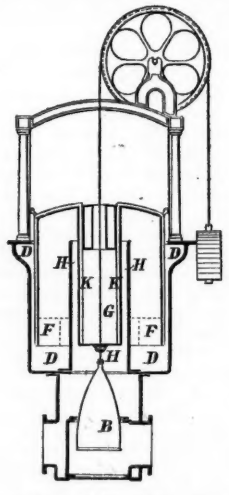
The object of this invention is to produce from certain iron ores, a material "applicable to the filtering or purifying of water, sewage effluents, . . . and of illuminating gas, sewer gas, air, and other gases, to the depriving chalybeate water of its iron, and peaty water and other liquids of their colour." The material employed is iron ore (whether in the form of peroxide or protoxide), pyrites, waste materials from aniline dye works, amorphous chlorite, chlorite slate, earthy chlorite, and other materials capable of being reduced into porous, solid, or powdery magnetic oxide of iron.

The patentee proposes to place the material to be treated in horizontal, slanting, or upright retorts—by preference provided with perforated shelves or gratings—stationary or moveable, or provided with stirring or raking appliances. The reducing agents employed for deoxydizing the material are liquid oils—such, for instance, as petroleum waste, sugar waste, blue paraffin, or other hydrocarbon oil—introduced in the form of spray or dropwise, or in a very thin sheet delivered in regulated quantities to the lower part of the retort, where it is vaporized, and rises up through the oxide, passing off by a pipe. Or coke, anthracite, asphalt, or other carbonaceous material may be delivered into the retort, by an Archimedean screw or other mechanical appliance, together with air in regulated quantity for producing carbonic oxide. Sometimes the oxide material is saturated beforehand with the oil or other deoxydizing substance; and this mixture is delivered into the retort by mechanical means. By continuing the process beyond the time just requisite for the production of a filtering material, a material results containing a larger percentage of carbon, which is also suitable for filtering purposes, but especially for use in the manufacture of steel.

Gas-Governors.—Milne, J., and O'Connor, H., of Edinburgh. No. 23,735; Dec. 11, 1895.

In a station gas-governor constructed according to this invention, the patentees claim the "application to the bell of a water chamber fed from the water in the tank by one or more syphon-tubes, in such a manner that, on the opening of the valve consequent on an increase of consumption, the quantity of water in the chamber is automatically increased; thus proportionally increasing the weight of the bell, and causing an increase of pressure as required."

To the bell of the governor, which rises and falls according to the outlet pressure, is connected (by chain, rod, lever, or other means) the valve or cone B, which regulates the flow of gas. The tank of the governor is made in concentric form; water being in the portion D. F are the floats (shown in dotted lines) frequently used for counter-



balancing the governor bell, either alone or in conjunction with the exterior weights. G is a water-chamber fixed to, and forming part of, the bell; and consequently rising and falling in and out of the chamber H. K are syphon-tubes passing from the bottom of the water-chamber G over the top of the bell, to the bottom of same on the outside.

As the bell falls, due to increased gas consumption, the water from

the tank passes through the syphons into the water-chamber, in such quantities as to keep the surface of the water of the tank and that in the chamber at the same level. In this way, the lower the bell falls, the greater the quantity of water passed into the chamber G; and in consequence the weight of the bell is increased, occasioning the desired larger pressure of gas to counterbalance it.

Gas-Engines.—Marks, G. C., of Grantham. No. 22,690; Nov. 27, 1895.

This invention has for its object to provide means whereby the explosive mixture taken into the cylinder of a gas or oil engine during the inhaling or outward stroke, may be compressed to the required degree during the compressing or inward stroke, whatever the volume of the explosive mixture may be. For this purpose, there works in the engine cylinder a secondary piston, upon the outer side of which presses a coil or other spring, of such strength that it can only be held in compression by a force equal to the degree of compression required multiplied by the area of the secondary piston. Projecting from the back of this secondary piston is a ram working in a hydraulic cylinder formed on, or attached to, the engine cover. The inlet and outlet to and from it are supplied with fluid, governed by a valve operated by hit-and-miss mechanism, so as to close it at the end of the compression stroke of the engine piston. By this arrangement, the secondary piston can only be forced back during the compression stroke, after the explosive mixture has attained the desired degree of compression, owing to the fact that the pressure of the spring has to be first overcome. Upon the completion of this compression stroke, however, the inlet and outlet valves of the hydraulic cylinder are closed; and a hydraulic buffer is thus formed, which will release the spring of any undue pressure when the maximum pressure in the cylinder is reached by the firing of the explosive mixture therein by the usual methods.

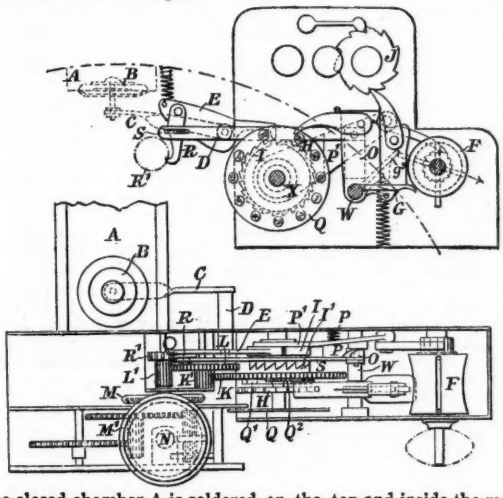
Dry Gas-Meters.—Milne, J., of Edinburgh. No. 23,736; Dec. 11, 1895.

In the provisional specification for this patent, the patentee says: "My invention consists in the construction of a composite dry gas-meter; the case consisting partly of tin plate and partly of cast iron. This has partially been done by various makers; but the construction of the ordinary tin case dry meter has always been materially departed from. I use the present form of dry gas-meter substantially as at present in use—merely substituting two cast-iron covers for the present tin-plate bottom and lower half of the sides and ends. These covers will be screwed together with the present division-plate of the meter between them. I make the inlet and outlet tubes preferably of incorrodible metal. I may either solder on the valve-cover and top, as at present, or make them of cast iron, and fix them with screws for easy removal."

Prepayment Gas-Meters.—Phillips, T., of Brussels. No. 18,891; Aug. 26, 1896. Date claimed under International Convention, March 5, 1896.

This invention relates to coin-freed apparatus for gas-meters wherein the coin, upon being inserted into a revolving drum, acts as a lever by pressing a pawl into gear with a ratchet-wheel, so as to impart motion to another wheel, the tooth of which, by releasing the end of a lever, enables it to move under the action of a spring; thereby opening a valve, and affording a passage for the gas issuing from the meter, after which the coin is dropped into a closed box or till.

The illustrations show an elevation of the part of the mechanism by which the movement of the coin controls the valve, a part of the registering mechanism of coins put in the meter, and the registering mechanism showing the number of coins for which value there is still gas unconsumed; also a plan of same.



The closed chamber A is soldered on the top and inside the meter; and from it the gas passes to the outlet. Gas coming from the meter cannot enter this chamber until the valve B is opened. To this end, the stem of the valve B is connected to a lever C secured to a spindle D, which passes through a stuffing-box (not shown) into the mechanism case. The spindle is secured to the lever E, one end of which is attached to a spring fastened to the top of the meter-case; while the other end bears on the tooth of a wheel hereafter described. F is a small drum, which is turned from the outside by a handle, and has a slot into which the coin is passed. The aperture of the slot being larger at one end than at the other, it holds the coin without allowing it to pass through the drum, unless the coin is of insufficient dimensions, when it passes through and has no action on the mechanism. A ratchet-wheel with a pawl allows the drum to turn only in one direction. The coin Z projects through the drum, so that when it is turned the coin raises a projection of a lever G against the pressure of the spring. The lever is pivoted on a spindle W, and carries a pawl, which acts on a ratchet-wheel H fixed on a spindle X, which carries a wheel I. When a particular point is on the top of the wheel in the position shown, it keeps the end of the lever E raised against the spring at the other end; and through the spindle D and the lever C, keeps the valve B closed. When the coin is put into the slot in the drum F, the wheel I is turned to the left, and its point leaves the point of the lever E, so that the valve B is opened; and this allows the gas to pass through the chamber A to the outlet. The lever G carries also a second pawl, held by a spring, and acting upon the ratchet-wheel J, which turns the first wheel of an index showing the number of coins put into the slot. When the drum F is sufficiently turned, the projection is moved into the position shown in dotted lines, and the coin is pushed by the projection in the direction of the larger opening of the slot (as indicated by the arrow), and projected by the spring out of the drum, so that it falls into a locked receiving-box.

Loosely carried by the shaft X is a cog-wheel K, which engages with a pinion K^1 fixed on the same shaft as a cog-wheel L; and by means of the pinions L^1 and the angle-wheels MM^1, it communicates with the spindle N, so as to work the ordinary meter-index, and in turn communicate motion to the parts above described. When the coin is placed in the slot, and the wheel I is turned, a lever O (having a sloping face), fixed upon the spindle W, by the rocking of the spindle, presses against a plate P, having a sloping face, and carried by an arm P^1. This arm is secured to the wheel I, which, in turn, is secured to one half of a toothed engaging wheel I^1; these parts being capable of movement with the shaft, but free to slide thereon. This movement of the plate P^1 disengages the halves of the wheel I^1, so that the wheel K, being thus freed, does not follow the movement of the wheel I to the left. When the coin has passed, the levers G and O come back to their original position; a spring pushing back the plate P, and putting the parts of the wheel I^1 into gear again, so that the mechanism is in direct communication with the ordinary index-spindle of the meter. This works the angle-wheels M M^1 L L^1 K K^1 and the wheel I, so that as the gas is consumed it turns to the right, until the point again presses against, and raises, the end of the lever E and closes the valve B.

More than one coin can be put into the apparatus at the same time, according to the amount of gas required. Each coin (through the handle) operates the lever G, wheel H, and wheel I one tooth to the left. The apparatus can be arranged to receive any number of coins at a single time—for convenience 10 is taken, as shown in the drawing. This number is indicated by the figures on the dial Q, carried on the shaft X, and turning with the wheel I. In order to be sure that the shaft will turn so as to give a uniform quantity of gas for each coin put in the slot, there is fixed on the shaft a star-shaped wheel Q^1, controlled by a spring Q^2 fixed on the wheel K, and which always has a tendency to drop into the teeth of the star-wheel. When a coin has been put in the apparatus, and the wheel I is disengaged from the wheel K, should the coin not be ejected from the drum F, the valve is kept closed by another motion; thereby making it necessary that the drum containing the coin should make a complete revolution before the gas is allowed to pass.

This is done as follows: Secured to the lever O is an arm S, having a slot in the opposite end, which works on a pin fixed to a pawl R pivoted to the lever E. When the lever is, by the pressure of a coin, forced towards the left, it pushes the ratchet R against a ratchet-wheel R^1, fixed on the same spindle as the pinion L^1, and prevents this ratchet-wheel from turning, after its movement has through the ratchet R drawn down the levers E and C and the valve B; and this consequently keeps the valve closed, and no gas passes.

Generating Acetylene Gas.—Boult, A. J.; a communication from H. F. Fuller, of Chicago, U.S.A. No. 19,288; Sept. 1, 1896.

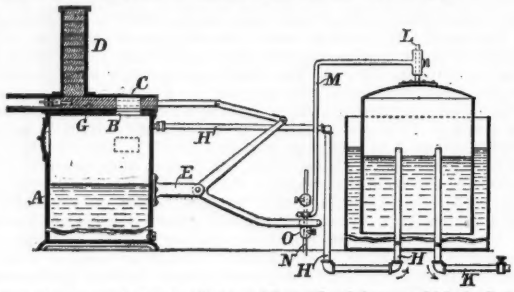
This invention relates to apparatus for generating acetylene gas by the action of water upon calcium carbide. The improvement aimed at is in the "gasometer variety" of such generators—especially of the portable kind—the action of which is to store the gas, and "cause it to exert a pressure upon the liquid element sufficient to separate, and maintain separated therefrom, the solid element, and thus discontinue the gas generation when or during the time that a desired predetermined degree of pressure of the gas is contained in the holder." One of the more important objects of the invention is to improve the construction of the holder for the calcium carbide, and thereby prolong, with a given quantity of the solid material (including a reserve supply thereof), the gas-generating action, by subjecting it progressively to the effect of the liquid, in contradistinction to subjecting thereto practically the entire bulk of the solid material at once; meantime utilizing the reserve supply of the calcium carbide for a dryer. Another object is to provide the supply of calcium carbide in separated quantities in such a manner as to avoid so compacting the mass, by the swelling effect upon it of the water, as to choke off the passage through it of the evolved acetylene.

Acetylene Gas.—Deuther, J. A., of Boston, U.S.A. No. 20,599; Sept. 17, 1896.

The object of this invention is to automatically control the positive generation of a determined amount of acetylene gas, by feeding a fixed quantity of the calcium carbide and adulterants to the water or other liquid contained in the generator.

A [next page] represents the generating chamber, formed with a tap hole closed by a plug, and an opening near the top provided with a cover. In the top of the generator is an opening or port B, for a purpose hereafter described. Over the top of the chamber, and secured thereto, is a chamber C closed on the sides and at one end to prevent the escape of gas, and open at the other end. It has upper and lower plates; and in the lower plate there is a port, which registers with the port B. Secured to the top plate is a hopper D, having a cover and a series of bolts, which secure the hopper to the top plate. The bottom of the hopper communicates with the chamber C; and in the hopper

are a number of tablets of calcium carbide, adapted to drop into the chamber C, and then be pushed forward towards the port B by the piston G, in its reciprocations in the chamber C. To the rear end of the piston is secured a rod, which extends rearwardly, and is pivotally connected to the cross-arm of the horizontal arm F on opposite sides of the chamber C, and at the front ends forms a cross-bar, to which is pivotally connected an arm, which, in turn, is pivotally connected to the arm of the bell-crank lever pivoted to a standard E, secured to the generator A. The lower arm of this lever is provided with a slot, in which is located the rod N; and on this rod, below the slot, is an adjustable nut O, having a set screw. The rod extends upwardly, and passes through the slot on the rod M; and above the rod is an adjustable nut, having a set screw. The rod M is provided with a sleeve; and, by means of a set screw, it can be adjustably located on the vertical rod L. This rod at its lower end is provided with a flange riveted to the top of the bell of the gasholder J, which is sealed in liquid, and capable of rising and falling according to the varying amount of gases stored therein. The gas generated in A passes by the pipe H to the bell of the holder, and is thence conducted for use by a pipe K fitted with a valve, which can be used to shut off the flow of gas.



Supposing now that one of the tablets of calcium carbide is dropped into the rectangular chamber C, from the hopper D, and has been pushed forward by the piston G (the apparatus, of course, being first started by hand) until it has reached the port B, whence it has dropped into the water of the generator. The gas evolved comes into contact with the water, passes over into the bell through the pipe H; and as the volume of gas in the bell increases, it raises the bell and the rod M, which acts on the rod N, and causes the arms to travel along the guides until the piston G is moved, so as to cause another tablet to drop into the chamber C. Now, so long as the volume of the gas is at a certain point, the bell of the holder will remain in its raised position; but as the gas is used, the bell will slowly fall, and with it the rods M and N, until still another tablet previously dropped into the chamber C in front of the piston will fall into the water in A, and the gas generated from it will pass over into the holder.

APPLICATIONS FOR LETTERS PATENT.

24,330.—Browning, A. G., "Stopping and sealing the mouths of gas-retorts and other analogous orifices." Oct. 31.

24,378.—Severac, G., "Acetylene gas lamps and generators." Oct. 31.

24,399.—Clay, W. R., and Walmesley, B., "Burners for incandescent gas lighting." Nov. 2.

24,411.—Cripps, F. S., "Manufacture of illuminating gas." Nov. 2.

24,414.—Smith, A. J. & A. G., "Automatic acetylene gas generator." Nov. 2.

24,440.—Resener, P. de, and Luchaire, H. L. A., "Apparatus for the manufacture of acetylene." Nov. 2.

24,441.—Glover, R. T. & J. G., "Gas pressure-gauges." Nov. 2.

24,455.—Prince, F. O'C., "Internal combustion motors." Nov. 2.

24,486.—Taylor, J., "Self-acting gas-regulator." Nov. 3.

24,502.—Pembley, J., "Compound lever safety-valve for steam, water, gas, or air." Nov. 3.

24,539.—Zschetzschingck, H., "Gas-oven or heating and drying stove." Nov. 3.

24,541.—Fowler, W. M., "Liquid meters." Nov. 3.

24,550.—Gathmann, L., "Gas-engines." Nov. 3.

24,558.—Lake, H. H., "Lamps adapted for producing and burning acetylene gas." A communication from Hanotier, V., and Hostelet, G. Nov. 3.

24,611.—Kay, A., "Portable apparatus for generating and storing acetylene gas." Nov. 3.

24,698.—Firman, W., and Cave, A., "Explosion engines." Nov. 4.

24,752.—Craig, A., "Gas and oil engines." Nov. 5.

24,779.—Gill, J., "Rotary motive power engines, applicable also to rotary pumps, air, or gas compressors and meters." Nov. 5.

24,798.—Ploetz, M., "Hot chamber for gas-stoves." Nov. 5.

24,804.—Ide, A. L., "Gas or other engines." Nov. 5.

24,805.—Lanchester, W., "Gas and oil motor engines." Nov. 5.

24,832.—Lewis, E. E., "Atmospheric gas and vapour burners." Nov. 6.

24,858.—Caldwell, R., "Governor applicable to gas-engines." Nov. 6.

24,956.—Riley, W., "Compressed fluid engine." Nov. 7.

24,991.—Kray, M., "Lamp chimneys specially applicable for incandescent gas lights." Nov. 7.

24,994.—Oechelhaeuser, W. von, "High pressure gas-engines." Nov. 7.

25,005.—Black, J. G., "Incandescent gas-lamp." Nov. 7.

25,008.—Greenall, J., and Heaton, T. T., "Coin-freed mechanism for meters." Nov. 7.

The Inspection by Gas Suppliers of Gas-Pipes in Houses.—In a General Bill to be promoted by them in the next session of Parliament, the Huddersfield Corporation will seek power to control the inspection of gas-pipes in new houses (not existing ones), so as to satisfy themselves as to the nature of the material, the size, and the strength of the pipes used. Similar power is possessed by the Water Department.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Friday, Nov. 13.

(*Before Justices* Grantham *and* Wright.)

In re the East London Water Company's Assessment Appeal.

To-day a motion arising out of the proceedings at the County of London Assessment Sessions on the 16th ult., on the assessment of the East London Water Company's property in the parish of St. John, Hackney (see *ante*, p. 744), came before the Court.

Mr. Littler, Q.C., applied, on behalf of the East London Water Company, for a rule *nisi*, calling upon the Guardians of the Poor of the Hackney Union and the Assessment Committee of the same Union to show cause why a writ of *mandamus* should not issue to the Justices sitting at Quarter Sessions for the County of London, commanding them to hear and determine an appeal. The learned Counsel said the property of the Company in the parish of St. John, Hackney, had been assessed at £15,223 rateable value. The Company objected to the assessment, and asked that the amount should be reduced to £13,170. The case came before the Assessment Committee twice, and on each occasion the valuer of the Company handed in a statement showing what alteration he desired to have made in the gross as well as in the net assessment. The gross and net assessments as they had been put down by the Overseers were allowed, and the Company appealed to Quarter Sessions. When the case came on for hearing, the respondents raised the point that when the Company went before the Committee they did not give notice that their objection applied to the gross as well as to the net assessment. The Court held that it was a condition precedent to the Company being allowed to appeal that they should have made an identical objection. He submitted that the Justices were wrong, and that he was entitled to a *mandamus*.

Their Lordships granted a rule.

[A similar point was raised in the case of the Grand Junction Water Company's appeal, as reported below.]

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Monday, Nov. 9.

(*Before Mr.* M'Connell, *Chairman, Mr.* Loveland-Loveland, *Deputy-Chairman, and a Bench of Magistrates.*)

The Assessment of the Grand Junction Water-Works.

Mr. Cripps, Q.C., M.P., and Mr. Boyle appeared for the Company Mr. Balfour Browne, Q.C., and Mr. Cunninghame Glen, for the Paddington authorities; Mr. Bosanquet, Q.C., and Mr. Danckwerts, for the parish of St. George's, Hanover Square. Mr. W. A. Valon was the Engineer advising the Assessment Committees in the various parishes, with Messrs. W. Eve and Son for Kensington, Mr. W. G. Cooke for Paddington, and Mr. R. W. Hedley for St. George's.

Mr. Cripps, in opening the proceedings, said that in the case of the Company against the Fulham Union, which was one of the appeals on the list, the authorities had agreed that the matter should be dismissed on terms that the parties had arranged; and the only order necessary for the Court to make would be that the appeal should be dismissed with costs.

Mr. M'Connell: Let that be so.

Mr. M'Moran, who stated that he appeared for the Fulham Union, consented to the course proposed.

Mr. Balfour Browne said that before Mr. Cripps opened his case for the Company, he (Mr. Balfour Browne) desired to take a preliminary objection—namely, that the learned gentleman could not appeal in the case against the gross value, on the ground that he had not failed to get relief as to that before the Assessment Committee. Precisely the same point was raised here as was submitted the other day in the East London Company's inquiry. In that case, the Court held that, under the circumstances (and they were the same in the present instance), they could not listen to the appellant in the argument that the gross value was wrong.* In the present case, the notice was to the effect that—"The Grand Junction Company hereby give the Committee and Overseers notice that we object to the said valuation list of the said parish of St. Mary, Paddington; and we further give you notice that the ground of our objection is" so and so (and they specifically stated, as they were bound to do under the Act, the ground of their objection). They declared that the rateable value of the mains and pipes laid under the streets was not correctly inserted in the valuation list; and they asked to have the list corrected according to their objection—namely, to have the rateable value put at £9671. This was the specific ground of objection. It was on that, and on that only, they could appeal to Quarter Sessions. The parish authorities had made a larger deduction from the gross value than the Company had done; and the latter could now simply say that the rateable value was wrong, and not the gross value. The Court, he held, had not jurisdiction to deal with a matter which did not arise out of the action of the Assessment Committee.

Mr. Cripps denied that the present case was on all-fours with that of the East London Company. Section 4 of the respondents' case clearly showed that the question of gross value was raised before the Assessment Committee. Not only was it raised, but the Committee reduced the gross value to £13,912 and the rateable value to £12,648.

Mr. M'Connell said that he should not feel inclined to alter the decision of the Committee in this instance without consulting Mr. Loveland-Loveland, the Deputy-Chairman, who had dealt with a similar case previously.

* Last Friday a rule *nisi* was obtained before a Divisional Court of the High Court of Justice to determine the correctness of this decision.

Some conversation then took place as to the desirability of going on with the appeal, and leaving the preliminary objection to be dealt with by Mr. Loveland-Loveland later in the day.

This was agreed to. After the adjournment,

Mr. BALFOUR BROWNE said that, as his learned friend had pointed out in the Paddington case, the Assessment Committee had altered the gross and rateable value. The Committee adjourned the case, leaving the amounts to be discussed by the valuers. Nothing came of that; but there was a reduction made in the Paddington assessment, the course taken in the Kensington case being somewhat different. The notice given was precisely the same; but when the Company came before the Assessment Committee, they were not ready with their case. In order, therefore, to give them an opportunity of coming again, the Assessment Committee, at the Company's request, raised the gross and rateable value by £1 each—merely to keep the matter alive. Afterwards the Company gave notice of reduced figures, and asked to have the rateable value corrected. He did not say a word about the gross; so that there was this slight difference between the cases of Paddington (which he had already dealt with) and of Kensington.

Mr. CRIPPS said that at the commencement of his argument he would point out that the appeal to the Court under section 32 of the Act of 1869, was an appeal against the decision of the Assessment Committee. In this case, the decision of the Committee affected both the gross and the rateable value—there was no question about that. Not only did this appear from the valuation list, but it was stated in the notice and appeal, and admitted by the respondents. He wished to emphasize the fact that the decision of the Assessment Committee did alter both the gross and rateable value, as it was a point of distinction between the present case and that of the East London Water Company.

Mr. M'CONNELL: The alteration was made after the service of the notice.

Mr. BALFOUR BROWNE: Not in the Kensington case.

Mr. CRIPPS said he was dealing only with the case of Paddington.

Mr. M'CONNELL asked when the reduction was made.

Mr. CRIPPS replied that a reduction was proposed on July 17, 1895; but on October 28, 1895, the final decision was given. The gross value was stated at £13,912, as against the former figure of £14,252; and the rateable value at 12,648, as against £12,956. Against this decision, the Company were now appealing in proper form, because they found fault with the decision of the Committee both as regarded gross value and rateable value. His second point was this——

Mr. M'CONNELL said the Court might relieve the learned Counsel from the duty of dealing further with the objection. They thought they ought to hear the appellants deal with the case on its merits. The Assessment Committee had dealt with gross and rateable value; and the appeal being against both, it should be heard on its merits. He was not dealing with the Kensington case.

Mr. BALFOUR BROWNE said that as the cases would have to be dealt with together, it would be well that the Court should decide the preliminary objection in regard to Kensington before proceeding further with the Paddington appeal. In this case there had been no alteration at all, save that of £1 in the gross and rateable value, at the request of the Company. This was long before any objection was made. After this formal alteration, the Company gave a notice of appeal to the Assessment Committee; and this notice referred simply to the question of rateable value, and did not mention the gross. After the notice, the Assessment Committee had not dealt with either. Therefore the circumstances were entirely different to those which existed in the case of Paddington, where, no doubt, there was a dealing with the rateable value and the gross estimated rental after the notice was given.

Mr. M'CONNELL: After the intimation we have given, do you think the objection you are making is worth insisting upon? Is it a substantial point that one public body ought to raise against another?

Mr. BALFOUR BROWNE admitted that the question he was raising did not go to the merits of the case, but was confined to jurisdiction. No doubt, as between two public bodies, it was a dangerous thing to raise small points which did not affect the main issue; but he wanted this matter settled once for all, because opposition was raised on this head in many quarters. He himself had been "hoist with this petard" by Mr. Boyle in the Isle of Wight.

Mr. M'CONNELL: Technically the objection has weight; but it has little weight from the point of view of the merits of the case.

Mr. BALFOUR BROWNE intimated that he would not press the objection.

Mr. CRIPPS said he would deal with the case for the appellants as against the three respondents. The question before the Court was really one of fact—whether the Water Company's figures were more reliable than those of the respondents. In the first case—that of Paddington—the gross value, as finally determined by the Assessment Committee, was £13,912; and the Company were asking that, instead of this, the figure should be £8725. The rateable value, which was fixed at £12,648, they maintained should be reduced to £7852. In the case of Kensington, the Assessment Committee's gross valuation was £17,887, as against the Company's estimate of £12,335; and the rateable value was £13,566, as against £11,102. In the case of St. George's, Hanover Square, the Assessment Committee's gross value was £10,560, as against the Company's £6803; and their rateable value was £9600, as against £6123.

Mr. DANCKWERTS said that his learned friend was now seeking, so far as St. George's, Hanover Square, was concerned, to reduce the assessment below the figures in the notice of appeal. He would ask the Court not to allow such reduction.

Mr. CRIPPS pointed out that the discrepancy was owing to an underestimate. Figures of this kind were not dealt with in great detail before the Assessment Committee. The process was a very expensive one, and was only resorted to on going to the Court of Appeal.

Mr. M'CONNELL stated that the Court would deal with the point when considering the figures. The Company might have had second thoughts, or even third or fourth thoughts; and all this would be thrown into the scale when they came to deal with the figures.

Mr. CRIPPS (continuing) said that in assessing the value of the property of a water-works company, they usually started with the gross receipts of the entire undertaking; and he hoped that as to this initial figure there would be no contest. The figure was £187,591 for the year ending Sept. 29, 1894. Expenses were put down at £5087; and tenant's capital—an allowance a tenant would expect to make in carrying on a business of this kind, and looking at the amount of capital he would have to embark—was put down at £75,432. Taking the usual 17½ per cent. on this gave £13,195. The Court, of course, would have to consider whether the £75,432 was a proper figure or not. After taking off tenant's allowance, they were brought down to £124,309. The next item was statutable deductions £20,600, made up partly by repairs (£8116), and partly by taking 1 per cent. on the value of the works, machinery, and indirectly productive mains, as found in the accounts of the Company (£9739). Then 1 per cent. on the productive mains worked out to £2068. Insurance for buildings at Ealing and elsewhere was £677; and all these items together made the £20,600, which left as the valuation of the whole undertaking £103,709. The next figure was important, and was arrived at by a process of actual valuation. Another way to obtain it would be to take the cost of the land and works from the Company's books, and put down 4 per cent. for the land and 5 per cent. for the works. If they had proceeded on this basis, the figure would have been larger than the one they had given, which was £64,000—made up by taking 4 per cent. on both land and works. Finally the Company arrived at the figure of £39,171 as the rateable value of the productive mains, *plus* rates. Dealing with this figure as against gross receipts, they found that it was 20·88 per cent. of what was called the water-rental. He would not work the figures out as between the various parishes interested. The first thing was to ascertain the correct figure; and when once this was found, the amount could be fairly apportioned.

Mr. *R. Vigars*, Vice-President of the Surveyors' Institution, Surveyor to several Railway Companies, The Gaslight and Coke Company, and numerous other public bodies, gave evidence in support of the opening statement of Mr. Cripps; showing how the items put before the Court by Counsel had been arrived at.

Witness was subjected to an exhaustive cross-examination by Mr. BALFOUR BROWNE. Dealing with the item of £670, rents of houses, he maintained that the houses in question were necessary for the accommodation of workmen; and he further pointed out that the houses were separately rated in the various parishes. The deduction in respect of Directors' remuneration, Secretary's salary, and so forth, was a fair deduction for tenant's interest; for if the tenant himself did not work, he would have to pay someone to do so. He (Mr. Vigars) considered it fair to deduct a sum for bank balance, and also one in respect of superannuation. If there was no superannuation, salaries would be larger. It was also right to make a reduction for repairs, as it was necessary to spend money on works to keep them in proper order. These repairs did not renew the structure, which would wear out in time.

Witness was under cross-examination by Mr. Danckwerts when the Court adjourned.

Tuesday, Nov. 10.

On the resumption of the proceedings this morning,

Mr. BALFOUR BROWNE said that, since the rising of the Court, his clients had placed themselves in communication with the other side, and had made some progress towards arriving at a settlement—not of the whole case, but by eliminating a good number of matters. They were practically agreed as to gross receipts. There was only one figure that Mr. Vigars admitted which, perhaps, ought to be added; and this was the rents received—£704. That, however, was a matter which could soon be adjusted. In the next item—working expenses—the figure of his clients came not far from the £50,000; and they had agreed that this figure should stand at £49,000, instead of £50,087. The only other figure was as to indirectly productive works. According to Mr. Vigars' estimate, this stood at £64,538; but the figure agreed upon was £60,000—the £4538 coming off.

Mr. M'CONNELL: That is in consequence of the values being admitted as to land and buildings?

Mr. CRIPPS said he had a table showing the figures agreed upon, and the way they would affect the questions before the Court. As to working expenses, the Company's figure was £50,000; and this they now read at £49,000. As to tenant's capital, there had been no agreement or arrangement; and the amount was in contest between them. As to statutable deductions, there was also no arrangement; and the figure would have to be fought out before the Court. Indirectly productive works was an item which would have involved a good deal of difficulty; but they had agreed that it should stand at £60,000, instead of £64,000—leaving the undertaking at large for rateable purposes at £44,796, as against £39,171. Apportioning this figure between the parishes of Paddington, St. George's, and Kensington, it still left a large difference as regarded Paddington and St. George's; but it brought the figures of the two parties close together with reference to Kensington. He was in hopes that the Court would not be troubled further with reference to Kensington, as the parties were so near agreement that there was every hope of an arrangement between them being effected.

Mr. BALFOUR BROWNE: I have heard of none up to the present.

Mr. CRIPPS: But it is not likely that we shall have much further contest.

Mr. BALFOUR BROWNE remarked that most of the difficulty had been as to the figure which was now £49,000.

Mr. CRIPPS said that, under the circumstances, it would be no use going on with the cross-examination of Mr. Vigars, who was in the box at the adjournment on the previous day. The only point undealt with in the cross-examination had been as to the valuation; and the parties were now agreed upon the matter.

There being some misunderstanding as to the extent to which the agreement entered into on the previous day affected the items remaining to be dealt with, a private consultation took place in Court between the contending Counsel and parties. At its conclusion,

Mr. CRIPPS said: There has been considerable advantage in our discussion; and I think it will be found that we have saved the Court a good deal of trouble. As regards Paddington, we have agreed to take the old rateable value before it was raised at the last quinquennial assess-

ment—namely, £12,340, the gross being £13,570. That is a reduction in the present figures of a little over £300. Though it is a material reduction to us, we are prepared to pay the taxed cost of the respondents on that settlement.

Mr. BALFOUR BROWNE: The taxed costs out of Sessions.

Mr. CRIPPS: Yes. As regards St. George's, Hanover Square, the proposed rateable value is £9600. We agree that the amount be reduced by £500—that is to say, to £9100—and there, again, we consent to pay the taxed costs of the respondents.

Mr. BOSANQUET: We agree to that for St. George's, Hanover Square.

Mr. CRIPPS: As regards Kensington, the amount is to be reduced £150.

Mr. BALFOUR BROWNE: The amount of the increased rateable?

Mr. CRIPPS: Yes; £150, making the figure £13,416. In the same way, so far as this order is concerned we pay the costs between the parties. We pay the costs in all cases. I think this is a satisfactory settlement to both sides.

A Dissatisfied Electric Light Consumer.

At the Lambeth County Court, a few days ago, Frogget's Electric Lighting Company sued Mr. Arden for the recovery of 18s. as rent of electric lighting lamps. In reply to a question by his Honour Judge Emden, defendant said: "I admit that I did hire the lamps; but I do not regard myself as being liable, because, instead of the light being equal to 16-candle power as agreed, it was not equal to a farthing rush-light. In fact the electric light as supplied by the plaintiffs was the laughingstock of the whole neighbourhood. I have asked the Company to remove the lamps before I kicked them into the street." A representative of the Company, who have a registered office in Lorrimore Street, Walworth, agreed that the light was bad at first, in consequence of defective connections; but he said it was better now. It appeared that there was no guarantee to provide a lamp of 16-candle power; and the defendant was therefore ordered to pay the claim, much to his disgust, for on judgment being given he observed: "No more electric light for me."

Responsibility for Waste of Water at a Military Barracks.

In the Queen's Bench Division of the High Court of Justice, Ireland, on the 5th inst., a case of interest to water suppliers in military districts came before Justices Johnson, Holmes, and Madden. It was a case stated for the opinion of the Court by the Magistrates of Wicklow under the following circumstances: The old Marine Hotel of Wicklow had been taken by the War Department for the purpose of being used as a military barracks; and the Wicklow Town Commissioners had also let the "Morrogh" of that town to the Department for a militia training-ground. A waste of water to the extent of several thousand gallons a day having, as alleged, occurred in connection with the premises, Captain Meade Dennis, the Adjutant of the Wicklow Artillery Militia, who was alleged to be responsible, was summoned by the Commissioners to the Petty Sessions Court for having in April of the present year wilfully and negligently wasted the water supplied to the camp. On his behalf, it was contended that he was not liable; but he was convicted by the Magistrates, who imposed a fine of 10s., with the alternative of seven days' imprisonment—their view being that, under section 60 of the Water-Works Clauses Act of 1847, or section 17 of the Water-Works Clauses Act of 1863, he was responsible, as being in command of the regiment at the time when the waste occurred. The contention on his behalf was that he was not liable because no evidence had been given that he did any act contributing to the waste of water, or that he had any knowledge that it was occurring, and also because he was not the person who was supplied with the water. The Court held that no case had been made against Captain Dennis, and quashed the conviction, but without costs.

The Gravesend Town Council and the Water-Works.—A conference took place last Wednesday between representatives of the Gravesend Town Council and the Northfleet District Council, in connection with the proposed purchase of the undertaking of the Gravesend Water Company, whose area of supply includes Northfleet. The result of the conference was the drafting of terms under which Northfleet, in the event of the purchase being carried out, will take one-third of the whole concern, according to their rateable value, have four representatives on a Joint Water Board of twelve members, subscribe one-third of the capital, and receive one-third of any profits realized. These terms were afterwards considered by the Northfleet District Council, and agreed to unanimously.

Huddersfield Corporation Water Supply.—The "Mayoral Statement" with reference to the work of the various departments of the Huddersfield Corporation in the past year, from which an extract was given in the last number of the "JOURNAL," contained the following particulars in regard to the water-works: The quantity of water in store in the Blackmoorfoot reservoir is 536 million gallons, as compared with 304 millions at this time last year. The renewal of mains during the year has been 2843 yards, as compared with 1084 yards before. The extension of mains during the year has been 2037 yards, compared with 2343 yards. The total length of water-mains is about 237 miles 277 yards. The number of gallons of water supplied through meter for the past year is 560,338,000 gallons, as compared with 471,559,000 gallons before; showing an increase for trade purposes of 88,739,000 gallons. The population supplied is: Inside the borough, 109,035; outside, 37,905—total, 146,940, as compared with 146,330 last year. The population is based on the number of houses supplied, reckoning five persons to a house. The number of houses added during the year has been: Inside the borough, 40; outside, 82—total, 122, as compared with 135 before. The number of meters fixed is 635, as compared with 605. The net income for water for the year to March 31 was £48,781 15s. 9d.; and the profit on the department was £2500, after putting £961 4s. 5d. to the depreciation fund.

MISCELLANEOUS NEWS.

BRITISH GAS TRACTION COMPANY, LIMITED.

The Statutory Meeting of this Company was held last Friday, at the Offices, No. 22, Chancery Lane—Lieut.-Col. W. T. ELLIS in the chair.

The SECRETARY (Mr. Percy Holyoake) having read the notice convening the meeting,

The CHAIRMAN said that, as this was only the meeting held in compliance with the Companies' Acts, the Directors could not have information of much importance to communicate to the shareholders, especially considering the short time the Company had been under their control. He would, however, endeavour to give them an insight into the business which they were carrying out, and which they trusted to develop fully in the future, so that they would be in a position to judge for themselves of the prospects before them. The British Gas Traction Company, Limited, was incorporated on July 18 last. The capital was £250,000 in £5 shares, of which £200,000 was offered to the public; and the Directors went to allotment on 22,578 shares, representing £112,890. In the prospectus the purchase price fixed by the vendor Company was £105,000, payable as to £55,000 in cash, and £50,000 in fully-paid shares; but as the capital was not fully subscribed, arrangements had been made with the vendors, who naturally had the success of the Company at heart, to defer payment of the £55,000 in cash, in order that sufficient working capital might be retained to carry on the business. Before referring to the work the Company were doing, he would mention that the system of equipping cars with gas-engines was tried originally in Dresden in 1893. Two years afterwards, a gas-motor car company was formed at Dessau, starting with seven cars and 2½ miles of line. This proved so successful that the line had since been considerably extended, and the number of cars proportionately increased. Besides this, several other similar companies had been formed in that part of Germany, which plainly showed that where this system had been tested the gas-motor car was eagerly adopted. The Dresden cars were constructed to carry 24 passengers; and the cost of running them was 3¼d. per mile. This sum included the pay of the driver and conductor, and gas for the engine. In the prospectus, a comparison was made with electric traction. He did not think, if the matter was carefully weighed, that the Company need fear in the slightest any electric, or, indeed, any other mechanical rivals. In the first place, the original outlay for central stations was a very large item; and after this outlay, there was not the adaptability to the requirements of tramway work which gas traction presented. Again, there was the very great danger to the public at large. When he said danger, he was not, he thought, stretching ordinary language; for the overhead electric system had been swept out of Washington, it was prohibited in New York, and even in Boston—the very centre and head-quarters of the system—it was condemned, and was to be removed in two years. He was not alone in the opinion he held as to the future of gas traction. No less a person than Professor A. B. W. Kennedy, F.R.S., shared his views to a great extent; and he did not think he could cite a better authority or more able critic, for he had had great experience in electrical and all kinds of mechanical traction. After some very exhaustive trials he had made of the Company's system, both in England and abroad, he had given it as his opinion that self-contained systems of traction had the great advantage that they could be used on any well-laid existing line, and that a breakdown or accident in any one car affected that car only, and not the system. The Professor went further than this. After his study of the system, and after comparing it with others, he expressed the opinion that until now there had no doubt been a question whether a scheme which looked so promising on paper and in experiments could stand the rough usage of actual work. So far as he could judge, the experiments had answered this question definitely and satisfactorily. On the other hand, in considering the merits of a system of mechanical traction for tramways, it must be borne in mind that tramway enterprises were not novel things. A large number of lines had been laid, and were worked mainly by horse traction; and, owing to the provision with regard to municipalities acquiring tramways, these were rapidly passing into the hands of bodies likely to have command of capital, and to be able to adopt improved methods of working. The qualities that would recommend any new system of traction were: (1) Adaptability to existing lines; (2) cheapness of adoption—that was to say, a small outlay of capital; (3) cheapness in working—that was to say, the working cost per tram mile must be low. Taking the first of these—the adaptability to existing lines—the Directors were convinced that the Company could claim to have no superior. No special track was required; but the cars were run wherever any form of mechanically-driven cars could work. But what was of still greater importance in the system was that it was capable of being worked into existing systems gradually, as it was found to answer the purpose of the undertaking. Take the case of any existing tramway worked by horses. One, two, three, or more gas-driven cars could be put on without disarranging the system, and the number of horses and horse-cars proportionately reduced. Being able to introduce the system gradually and without difficulty into existing undertakings was commercially of great importance; for, on the one hand, companies were willing to try experiments which did not involve a large capital expenditure, nor pledge them to the adoption of some costly system, and, on the other, nothing was so effective in inducing them to adopt a new system as the fact that the company had actually tried it themselves. This brought him to the next head—the small outlay of capital needed; for the system of gas traction required no fixed plant beyond a small engine for compressing the gas. Plant of this kind for a fair size of tramway only cost about £500, and could be put in the space occupied by stalls for two or three horses. No other outlay in the way of fixed plant, excepting the purchase of the cars, was required. A great deal was heard about electric traction and cable traction. In both of these systems, many thousands of pounds' worth of fixed plant had to be laid down and kept in going order, with all the expenses of working, before the system could be adopted at all, even experimentally. It could not be denied that this was an enormous advantage on the side of gas traction. But, of course, the amount of fixed

capital required was not the only element. Cheapness of working cost was equally important, and might even exceed the charges for interest and depreciation of fixed capital. But here the Directors claimed that they stood first among the many competitors. The figures of their experiments and the practical experience obtained from the Blackpool line,* showed that results could be attained by gas traction which were lower than by any other system; and they were full of promise of still further reduction. The simplicity of driving, the cheapness of the mode of producing power, and the simple requirements in the way of labour, otherwise than that of the driver, made the system extraordinarily cheap. Compared with competitors, there was hardly any item of expenditure which was higher in the case of gas traction than in that of other systems; while on other heads, it entailed either much smaller expenditure or none at all. In all these three main considerations, the great advantage of gas traction manifested itself. One of the difficulties present in all large undertakings such as tramway companies was that of management, when the number of men employed was large. This difficulty manifested itself most seriously when the employer was a municipality, and when the undertaking had to deal with horses, which needed continual attention, and the maintenance of which required much management. These difficulties were minimized in the gas traction system. Beyond the driver—which all systems must have—the amount of labour was exceedingly small, and substantially reduced itself to the question of repairs, which were easy to deal with on a large scale, on account of the uniformity in the construction of the cars and the interchangeability of their parts. Then the motive power—gas traction—was in the direction of the flowing tide. No one could have followed the general development of the motor car without seeing that the solution of the difficulty of such locomotion was to be found in the petroleum or benzoline engine; and this was only another form of gas-engine necessitated by the difficulty of carrying gas in small cars. The system of gas traction was a step in the same direction, utilizing in a larger car the fuel in its best—that was to say, in its gaseous—form. Already this sort of prime mover had proved to be the cheapest kind of stationary engine. There were works in England which, by gas produced from anthracite coal, obtained their power at an expenditure of fuel of something like half the best results obtained by steam. Though the Directors preferred to use ordinary lighting gas, on account of its superior convenience, the system was applicable to all these forms of gaseous or vaporized fuel, which were just coming to the front. When the shareholders considered that the power was generated directly, and used on the car upon which it was generated, without the interposition of any intermediate system of mechanism, he thought they would agree with him that the Company were in a position to avail themselves of the most promising developments of modern science in the way of cheap generation of power; and he trusted that at the next meeting he should have the pleasure of stating that the Directors' views had been endorsed in the most practical manner the shareholders desired.

Several questions having been put,

The CHAIRMAN, in reply, stated that the cost per mile of the German car was 3¼d.; but the car was constructed to carry 24 passengers. The Company's cars would carry 42; and they found, after running them for fourteen weeks, that the cost per mile was 4¼d. Therefore, although their accommodation was nearly double that of the German cars, the expense was not much more. The cars now being constructed would carry 52 passengers; and he believed the increased cost would be very little. The business of the Company was to supply traction for tramways; and, therefore, they had not at present gone into the question of light railways. No doubt, later on they would give their attention to them. The Directors were in negotiation with tramway companies in many parts of England with regard to supplying gas traction. So far the Company had not any works of their own; but they were looking about for a good situation.

A vote of thanks was given to the Chairman and Directors, which was briefly acknowledged; and the proceedings terminated.

SOUTHAMPTON GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held on the 4th inst.—Mr. R. C. HANKINSON, J.P., in the chair.

The report of the Directors on the working of the six months ending June 30 stated that there had been an increased sale of 4,612,000 cubic feet of gas, compared with the June half of 1895. This was very satisfactory, considering the unusual mildness of the weather during the March quarter. A reduction of 2d. per 1000 cubic feet, made in April, 1895, was estimated to occasion a loss of rental of £1400 in the half year; but the actual loss was only £273. It was anticipated that the increased consumption in the next half year would fully justify the Directors in having reduced the price of gas to the low rates of 2s. 6d. and 3s., which now benefited the consumers to the extent of £3100 per annum. Referring to the low prices of residuals, especially of coke and sulphate of ammonia, the Directors said the amount derived from these products was £1021 less than in the corresponding half of 1895; and there appeared to be no present prospect of an improvement in value. The report also mentioned that in July a sale by tender of £5000 of 5 per cent. perpetual debenture stock realized £8025; being an average of £160 10s. per cent. The premiums amounted to £3025; being an increase of £382 10s. upon the last sale of this stock. The profit and loss account showed that the amount available for dividend was £7609; and he Directors recommended that £704 be drawn from the reserve fund, in order to pay the maximum dividends, amounting to £8313 for the half year.

The CHAIRMAN, in moving the adoption of the report and accounts, said the Board regretted that the report was not of quite so flourishing a character as others previously presented; but there was not the least cause for uneasiness, and still less for alarm. The amount available for dividend included £2029 brought forward; and to make up the maximum dividends, the Board proposed to take £700 from the reserve fund. The reduction was due to two causes—the principal of these being the great decline in the value of the residuals; but in this respect they were only having the same experience as other companies. He hoped it was but a temporary depression; and, indeed, he saw that day that sulphate of ammonia was improving, only slightly, it was true, but still it was improving. He believed the shareholders would agree with the Directors that it was much better to make up the dividend from the reserve fund than to increase the price of gas, which was always an undesirable thing to do, unless it was absolutely necessary. On the other hand, they had considerable encouragement in the working of the business; for there had been a substantial increase in the quantity of gas sold as compared with the June half of 1895. They sold 4,600,000 cubic feet more, which was not so large an increase as in some former half years; but it must be borne in mind that the winter of 1894 was a very severe one, while that of 1895 was exceptionally mild. During the current six months, however, the increase was already 9 million cubic feet over the corresponding period; and, if they continued at this rate, the increase this half year would be the largest they had ever known. Another reason why the profit was somewhat less was the reduction in price; but the fact that the difference in this respect was only £272 was very satisfactory, as it meant that the Company had sold so much more gas to compensate for the loss. The works were going on very satisfactorily; and the use of gas-engines, cooking-stoves, and gas-fires was increasing.

The motion, after a short discussion, was carried.

The maximum dividends having been declared,

The shareholders duly acknowledged the services of the Chairman and Directors, the Secretary (Mr. C. Crowther Smith), the Engineer (Mr. S. W. Durkin), and the staff.

EXTENSIONS AT THE PLYMOUTH GAS-WORKS.

In "Greater" Plymouth—so called from the recent incorporation into the borough of several large suburban districts—the increasing demand for gas has necessitated the making of some very important additions at the works of the Plymouth and Stonehouse Gas Company. Having installed West's stoking machinery in the new retort-house, the Directors, it may be remembered, dealt next with the storage, by the erection of a new four-lift holder, of a capacity of 2 million cubic feet. During the present year, the three existing tower scrubbers have been raised to a height of 90 feet, and filled throughout their entire area with Livesey boards. The inlet and outlet mains are 2 feet in diameter, with self-acting liquor distributors and machinery rooms, access to which is attained by means of a spiral staircase with wrought-iron landings. New and powerful patent Pearns double-acting liquor-pumps, capable of lifting 9000 gallons of liquor per hour, have been erected to supply the enlarged scrubbers with the necessary volume of liquor. The scrubbers have been recently put into operation, with excellent results. They are both ornate and substantial, and form a most valuable addition to the apparatus. The extensive coke-yard, 480 feet long, of a maximum width of 73 feet, has been covered throughout with a massive steel roof, supported on one side by the retort-house wall and on the other by means of wrought-iron steel joists 27 feet high. The roof is plated with corrugated iron, and there are suitable skylights the whole length. By this arrangement, all the coke made is manipulated under cover. These improvements have been designed by Mr. John West, M.Inst.C.E., the Company's Consulting Engineer; and the whole of the work has been manufactured and erected in a thoroughly satisfactory manner by Messrs. Willey and Co., of Exeter.

GAS-WORKS EXTENSIONS AT STOCKPORT.

Opposition to Water-Gas Manufacture.

Last Wednesday, Colonel J. O. HASTED held an inquiry at Stockport relative to an application by the Corporation to the Local Government Board for sanction to borrow £43,000 for gas-works purposes.

The TOWN CLERK (Mr. W. Hyde), in opening the case for the Corporation, gave particulars as to the present manufacturing capacity of the three works of the Gas Department. He said that at Portwood they had 60 retorts, 72 tons of coal were carbonized per day, and the make of gas was 750,000 cubic feet. At Heaton Lane, the figures were: 91 retorts; 78 tons of coal carbonized; and daily make, 900,000 cubic feet. At Millgate, 25 retorts; 30 tons of coal carbonized; and daily make, 240,000 cubic feet. The total daily production at the three works was 1,890,000 cubic feet. In 1896 this was increased to 3,130,000 cubic feet. The borrowing powers sought were for the following objects: A coal-testing plant, and the fitting up of a laboratory, necessitated by the need of constant supervision of the residuals and gas made, and for research work. The maximum 24 hours' make, without the Millgate works (which it was proposed to abandon), now stood at 3,130,000 cubic feet, or slightly less than the maximum 24 hours' consumption, which last year was 3,191,000 cubic feet. As this did not give any margin at all for breakdowns or necessary repairs during the winter months, it was felt to be absolutely necessary for additional carbonizing plant to be put in hand for the coming winter. After careful consideration, it was decided to go in for carburetted water-gas plant, as being more cheaply and quickly erected, and also as affording advantages not possessed by the ordinary retort-settings. The additional 500,000 cubic feet per day which they would thereby be enabled to make would carry on the works for three years, estimating the increase to be about 5 per cent. per annum. The sole objection raised against water gas had been that it contained a rather heavy percentage of carbonic oxide. In practice, however, this objection had never been found to be serious, owing to the fact that the oil gas which it was necessary to use with the water gas in order to obtain any illuminating effect gave such a penetrating odour to the compound that any escape, however slight, was at once and even more rapidly noticed than with ordinary coal gas. The report of Professor Crum Brown to the Edinburgh and Leith Gas Commission, as published in the "JOURNAL OF GAS LIGHTING" for March 24 last, gave the result of very thorough investigation on this point; and in addition to this, as it was only proposed at present to use about 25 per cent. of carburetted water gas as a mixture, the carbonic oxide contained in the mixed gas

* An account of the opening of this line was given in the "JOURNAL" for July 14 last (p. 68).

would hardly exceed 13½ per cent.—the coal gas itself being responsible for 7 per cent. of this. Further, money was required for fitting up workshops, offices, and stores, the paving of the workshops, a new weighbridge, an exhauster, a station meter, the extension of the meter-house, altering the retort-house, and adding a lift to each of the two holders at Portwood. It was estimated that the capacity of the holders would be increased by 974,000 cubic feet.

A letter was read from Mr. J. Haddock, an analytical chemist, protesting against the proposed use of water gas as poisonous.

Mr. CARTLEDGE said he had read that Mr. Newsome, a great authority, had stated that 1 per cent. of carbon monoxide was fatal, and that oxygen would not displace it as it would carbonic acid gas. As a gas consumer, he protested against the use of water gas.

The TOWN CLERK pointed out that Birmingham was spending £600,000 upon this system; and Southport had adopted water gas.

Mr. *S. Meunier*, the Corporation Gas Engineer, made a statement in reply to the assertions as to the poisonous properties of water gas. The only danger that could possibly arise from the carbonic oxide poisoning with the system which they proposed to adopt, would be through an escape of gas. Under such a circumstance as the gas being turned down low, and a draught from the window blowing it out, ½ cubic foot per hour would not be exceeded. Taking it that there was 13 per cent. of carbonic oxide in the gas, as a maximum, this would mean that it would take 20 hours at least before a sufficient quantity of carbonic oxide would be emitted for the symptoms to begin to appear in a room 12 feet by 9 feet in size.

Mr. *Haldane*, who had made numerous experiments, supported Mr. Meunier's statement. It was true, he said, that carbonic oxide gas had no smell; but the water gas would be of no use for lighting purposes without ingredients in it that smelt very strongly. They had to make oil gas for lighting, and simply used water gas as a carrier; and the gas they would produce would have such a strong odour that it would be detected even more quickly than ordinary gas. The smell was so noticeable that long before any practicable danger existed, it would be discovered. It could only be under most extraordinary circumstances that an escape in a room could be dangerous.

The Inspector visited the works and examined the plans.

THE PROPOSED PURCHASE OF THE FALMOUTH GAS AND WATER WORKS BY THE CORPORATION.

A Meeting of the Falmouth Town Council was held last Tuesday—the MAYOR (Alderman C. Doble) presiding—to consider the question of the purchase of the gas and water undertakings, and, if approved, to authorize the promotion of a Bill in Parliament for the purpose.

Mr. J. GROSE moved that the Corporation promote a Bill for the purchase of the undertaking of the Falmouth Water-Works Company, and for obtaining further powers with reference to the supply of water; also to enable them to exercise the powers conferred by section 69 of the Falmouth Gas Act, 1890, with reference to the purchase of the undertaking of the Gas Company, and further powers to be acquired respecting the supply of gas.

Mr. H. LIDDICOAT, in seconding the motion, said the proposal was brought forward with the intention of lessening the burden of the rates. It was clearly shown that, if they acquired the gas and water works, they would have some money for the immediate relief of the rates, and the prospect of more considerable sums later on. As to the gas-works, the powers of purchase conferred upon the Corporation by the Act of 1890 would expire in a few years; and in the meantime the works were becoming of greater value.

Mr. S. COLLINS said they were told that the profits from the gas-works would go to the relief of the rates. If there was any profit, he thought the consumers should have it.

Mr. G. H. Fox remarked that from a sanitary point of view, it would no doubt be well for the Corporation to get the water-works into their own hands; but the proposal would have to be tested in its financial aspect. As to the gas-works, Mr. Silverthorne estimated the cost of obtaining an Act of Parliament at £1200; and there would be an arbitration, which would perhaps cost hundreds of pounds more. The purchase of the water-works would mean either that the Council should come to the Company's terms or agree to others, or that they should fight a contested Bill in Parliament. They would also have to make arrangements with the Penryn Corporation, who were interested, or encounter their opposition in Parliament. What the costs would be, it was impossible to say. Mr. Silverthorne wisely and properly protected himself in many ways. He stated that his data were only inferential; but his report was a very sanguine one. They were informed that a profit of £900 on the gas-works was assured. But Mr. Silverthorne did not say so; and the calculation was made by deducting the prospective expenditure from the prospective revenue. Mr. Silverthorne's calculation was based, not on an average of three years' trading, but on a year of exceptional profit, and on a sale of gas 4 million cubic feet in excess of the sale in any year of the Company's history. As to the water, so far as he could see, Mr. Silverthorne did not profess to anticipate a profit, but, on the contrary, thought there would be a distinct loss of £500, to be made up by saving £157 in expenses of management, £110 in Directors' fees, £117 in London expenses, and by an increased revenue of £300. It was sanguine to anticipate that they could save so much and make that increased revenue at the same time. The Gas Company had fulfilled their obligations.

Dr. BANKS said Mr. Silverthorne estimated the cost of the gas undertaking at £34,000. If they had to pay £40,000, and an additional £1000 for costs, and £1000 for the extension of the works, the total would be £42,000. If they borrowed this for forty years, the annual instalment of principal and interest would be £1820. The profit made by the Company last year was £2200; so that, even upon this increased sum, and without addition to the revenue, the profit would be £400. As to the water-works, they must not lose sight of the fact that the consumers would be charged upon the net instead of the gross rateable value; and this would put into their pockets the equivalent of a rate of 4d. in the pound.

The resolution was carried by eleven votes to one—two members abstaining from voting.

ELECTRIC LIGHTING NOTES.

The promised report of the St. Pancras Electric Lighting Department as to the means to be taken to prevent intermittent lighting was presented to the Vestry last Wednesday. The recommendations of the Committee, calling for a further expenditure of upwards of £8000 were prefaced by a clause, in which they expressed the opinion that the best means for preventing any of the thoroughfares lighted by arc lamps being left in total darkness through any interruption in the supply, would be to re-arrange the whole of the present high-tension arc lamp circuits, and connect every alternate lamp to the low-tension mains. By adopting this method, several important advantages would, they said, result—primarily, the protection against the total extinction of the lighting in any district. A further advantage would be gained in being able to utilize the mains at present unproductive in consequence of the necessity for laying them in parts in which, owing to open spaces and other circumstances, current was not required. Then follow the items comprising the cost of providing and laying the necessary conduits—a total of £2134. This little matter was agreed to by the Vestry with hardly any discussion; for did not the Committee add that they considered "the advantage of being secure from any future total extinction of the arc lamps in the public thoroughfares fully justifies the expenditure referred to"? A further recommendation of the Committee was that £3966 should be spent on "laying additional mains to meet the growing demand;" for, "in consequence of the low-tension mains being laid in some of the thoroughfares on one side of the street only, the demand for supply is greater than the present mains are capable of carrying." Here, again, follows a list of the requisite new mains, together with this lucid explanation of the Committee: "It is desirable that the foregoing works should be carried out to avoid the present costly method of crossing the road, which is necessary whenever a consumer on the opposite side of the street to that on which the main is laid requires a supply. In course of time, it will be necessary to lay mains on both sides of the street; and then the whole of the connections crossing the road will be valueless, and the money spent in laying them wasted. Your Committee consider that the best interests of the parish will be served if this work is carried out at the same time as the work in connection with the extension of the public street lighting, as not only a large saving will be effected by the combined works being carried out together, but the great inconvenience in disturbing the footways a second time will be avoided." The Vestry thereupon sanctioned this expenditure also. The Chairman of the Committee (Mr. Cox) explained that certain northern thoroughfares of the parish might at the same time be lighted by electricity, in order to join the proposed extensions of the neighbouring Vestries of Hampstead and Islington. As the cost of these extensions was only to be another little item of £2000, this, too, was agreed to. The Vestry were in such a humour for voting away the ratepayers' money, that another sum of £400 was asked for, and granted, to extend the alternating system over the whole parish. But even this was not all. Not content with getting this £8000, the Committee recommended that the Vestry should make a special application to the London County Council, asking that the Council should, without any further delay, either grant, or give their sanction to the Vestry to borrow elsewhere the loans for which applications have been made. This was agreed to; so another £18,000 will soon be in the hands of the Committee.

At the last meeting of the Newington Vestry, a brave attempt was made by the more sober-minded members to end the electric lighting movement once for all. The Committee recommended that the Vestry Clerk be authorized to issue the requisite statutory notice of the Vestry's intention to apply for a Provisional Order. A direct negative was moved as an amendment; and, though its supporters laid stress on the disclosures at the recent Board of Trade inquiry, the Inspector's report on which was decidedly antagonistic to the proposed scheme, it was rejected by 40 votes to 12, and the notice is to be issued.

In our "Electric Lighting Memoranda" last week, when referring to the recent failure of the electric light in the City, we remarked upon the economy to be effected by owners of private establishments putting down a gas-engine and dynamo, and supplying themselves with electric light, instead of taking it from the public service. This point is very well put in a circular which the Engineer and Manager of the Hastings and St. Leonards Gas Company (Mr. C. E. Botley, Assoc.M.Inst.C.E.) has for some time been issuing, setting forth the advantages of gas, which is now supplied by the Company at the reduced price of 3s. per 1000 cubic feet. He points out that where it is desired to use electricity for special purposes or advertisement, the cheapest way of producing it, where the requirements are sufficiently large, is by having a self-contained installation with gas motive power; and, in order to show that there is no antagonism to the new system by the Company, he says they are prepared to undertake the work of installation. The Company have officers practically acquainted with electric lighting, and they can furnish reliable data as to working and maintenance. The Company have, in fact, an electric lighting installation of their own.

The reports of the Elective Auditors of Nottingham (Messrs. W. Gath and Mark Mellers) on the accounts of the borough for the year ending March 31 last have been published. In regard to the Corporation Electricity Department, Mr. Gath furnishes a revenue account, showing the sales of current, &c., to be £4295; and after deducting all expenses, interest on capital, and contribution to sinking fund, a net profit of £502 remains. Mr. Mellers says there is "evidence of growth in the sale of current," and also "that a large part of the receipts come from the Corporation for public institutions. So far the progress cannot be said to be equal to the sanguine anticipations of some of the promoters." The "Nottingham Express" believes "it is a fact that the Corporation departments contribute about one-twelfth part of the receipts of the Electricity Department."

The electric lighting works of the Chester Corporation are practically complete; and it is expected that the current will be supplied to the street-lamps, and the customers connected with the system, by the end of this month. The works have been constructed in about 29 weeks; and an imposing feature of them is the chimney, which stands 140 feet

high from the finished ground level, and is 7 feet square at the base. In the engine-room, two engines have already been fixed, and another will shortly be put into position. Each one is coupled direct to dynamos capable of generating 184 ampères at 440 volts, sufficient to light 2500 lamps of 8-candle power each. At present 48 arc lamps of 2000-candle power are to be erected in the streets; and as to private business, there have been about fifty applicants for the light, including some of the principal tradesmen.

A proposal has been brought before the Shoreditch Vestry by the Electric Free Wiring Syndicate, who offer to fit up consumers' premises without any initial charge; the stipulation being made that the consumer so wired should pay ¾d. per unit more for the energy supplied to him than would be charged one who paid cash for his wiring—the Vestry to pay the ¾d. per unit to the Syndicate. The Vestry have approved of the scheme. The Clerk is to draw up an agreement, which is to include a clause giving the Vestry the option of purchasing at any time after three years, or any consumer after five years, on terms to be settled in detail. The wiring to be done to the satisfaction of the Vestry's engineers; and the contract not to be exclusive of other firms of free wirers. The Vestry are to make application to the London County Council for a loan of £17,000 for electric lighting.

A discussion has been going on in the "Yorkshire Herald" on the well-worn topic of the comparative cost of gas and electricity. A writer who concealed his identity under the *nom de plume* of "Citizen," ventured to assert that the cost of electric light is far in excess of that of gas. This was only repeating an old story; but it is sometimes beneficial to reiterate generally accepted truths. However, "Citizen's" statement drew a reply from Mr. Charles W. Sax, who triumphantly called his attention to a report made by Mr. W. H. Preece to the Lambeth Vestry in 1892, in which it was stated as follows: "It has been the fashion to regard the electric light as the lamp of luxury; and strange views are frequently expressed as to its costliness, and as to its being within the reach only of the rich. The experience at Newcastle, where gas is only 1s. 10d. per 1000 cubic feet, and at Bradford, shows that it is now within the grasp of the poor man. The average cost per electric lamp per annum at the former place was last year 6s. 3d., and at the latter place 9s. 7d. The relative cost of electricity and gas is not a matter of speculation or calculation; it is a matter of fact. The average consumption of gas per ordinary burner, giving practically 10 candles, is 3000 cubic feet per annum; while the average consumption of electrical energy per glow lamp, giving an equivalent light, is 18 supply units per annum. Each will cost 9s., if gas be supplied at 3s. per 1000 cubic feet and electrical energy at 6d. per Board of Trade unit." This extract, coupled with the fact that electric lighting is rapidly extending throughout the country, was, Mr. Sax thought, sufficient answer to "Citizen." The latter gentleman, however, did not so regard it. Moreover, in a second letter, he charged Mr. Sax with ingeniously evading the main issue. In his first communication, he compared the worth of the electric light and gas light; and, in reply to a statement contained in a circular distributed over the city, that electricity at 6d. per unit is equivalent to gas at 3s. per 1000 feet, he said that "the real comparison is that 6d. per unit of electricity is, according to recognized authorities, equal to gas at 6s. 4¾d. per 1000 cubic feet, and neither a gas nor an electric light authority will contradict this statement, as being practically correct." Instead of accepting this challenge upon the accuracy of the comparison, Mr. Sax quoted an extract from a report made in 1892 by Mr. Preece, in which he gave the average annual cost per electric lamp per annum at Newcastle and Bradford. "What," asked "Citizen," "has this to do with my statement of the comparative worth of the two lights?" He answered his own question in the negative. In order to illustrate the misleading character of the reasoning contained in the extract given by Mr. Sax, "Citizen" put the following case: "Let us assume the case of an individual who (say) has gas-lights in his house, but only ten in regular use, while the remainder may be in bedrooms and places where they are only required occasionally, and for short periods—in other words, where the latter will not use 1-20th the amount of the gas consumed by the burners in regular use. When this difference is taken into account, it will be seen, by the veriest novice, that, if the total gas bill is divided by the total number of lights, the cost per burner may seem small; and if the proportion of burners in regular use is less than ten, the veriest novice will see that the cost per burner will be smaller. Precisely the same theory will apply to a house using twenty electric lamps or lights, or to the two specially selected towns of Newcastle and Bradford." As to the conclusion arrived at, that each light would cost 9s. per annum if gas were supplied at 3s. per 1000 cubic feet, and electrical energy at 6d. per Board of Trade unit, "Citizen" pointed out that, to arrive at this result implied a depreciation of 16-candle gas to the extent of fully 50 per cent.—viz., to about 7¾-candle power, or an appreciation of the electric light to the extent of nearly 30 per cent.; while, if even the statement as to candle power were correct, the cost of 3000 cubic feet of York gas, at 1s. 10d. per 1000 feet, the price charged to the largest consumers, would be 5s. 6d. instead of 9s., and at 2s. 1d., the price charged to the smallest consumers, it would be 6s. 3d. instead of 9s. After this, it was unkind of "Citizen" to invite Mr. Sax to try his hand at comparing the worth of light produced by incandescent gas-burners and that given by incandescent electric lamps, and endeavour to contradict the statement recently made by the Chairman of the York Gas Company that the light emitted by the former system, using York gas, was quite twelve times cheaper than the electric light.

New Water-Works for Ledbury.—Several schemes have been proposed from time to time for improving the water supply of Ledbury; but in each case they have failed. The Local Government Board have now stepped in, and have urged the Council to increase the supply forthwith. With the view of meeting the difficulty, Mr. H. Biddulph, M.P., who is a member of the Council, has moved that body to appoint a Committee to consider the question of providing for the storage of water from what are known as the Coneygree and Brickyard springs. He has made investigations, with the result that he is of opinion the Council can obtain a storage supply of some 4 million gallons for about £3000. He has also offered to let them have a site for the proposed reservoir on fair terms, and is willing they should have a quarry at Coneygree for the purpose.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Proposed Acquisition of the Water Undertakings.

At the Meeting of the London County Council last Tuesday—Sir A. Arnold in the chair—the above question again came under discussion on a report presented by the Parliamentary Committee, the principal features of which were noticed in the "Journal" last week (p. 897). On the 21st of July, the Council passed resolutions to the effect that a Bill or Bills should be prepared for introduction in Parliament in the session of 1897 for the purchase of the undertakings of the eight Metropolitan Water Companies, and that the Parliamentary Committee should submit them. The Committee accordingly considered the matter, and embodied the results of their deliberations in the following report:—

Having in mind the opposition offered to the previous Transfer Bills promoted by the Council, we have carefully considered whether it might not be possible to prepare a Bill or Bills upon lines which would commend themselves to the great majority of the Council; but we greatly regret that we have not been able to come to a unanimous conclusion. In view of the importance which we attach to a general agreement in regard to this question, we think it right to inform the Council in some detail of the steps we have taken. We thought the best course would be to appoint a representative Sub-Committee, which we hoped would be able to settle the provisions of an agreed Bill. We resolved that the Sub-Committee should consist of the Chairman (Mr. M'Kinnon Wood) and Vice-Chairman of the Committee, Mr. Dickinson (the Chairman of the Water Committee), Lord Onslow, Mr. Harris, Mr. Cornwall, the Chairman of the Council (Sir A. Arnold), the Vice-Chairman (Dr. Collins), and the Deputy-Chairman (Mr. Beachcroft). The Sub-Committee held nine meetings, and gave the whole question their most careful consideration. They have reported the following heads of agreement suggested by them for presentation to the Council as the main provisions of an agreed Bill in the event of their proving generally acceptable to members of the Council.

Heads of Agreement.

1.—Council to take power to acquire the undertakings of the Water Companies by agreement; provided that if the Council acquire any one or more of the undertakings, it shall also proceed with the object of acquiring the rest.

2.—Council to take power, in default of agreement, within one year after the passing of the Act, to purchase compulsorily on arbitration terms.

3.—The following clause (subject to Counsel advising as to form and drafting) is agreed on the understanding that it leaves it open to the arbitrators to consider the question of value from the point of view alike of the Company and of the Council, and also on the understanding that, to quote the words of Mr. Plunket, "it is absolutely clear that the arbitrators are not to be precluded by any legal objections from entertaining all the circumstances which they may think it right to take into their consideration":—

The consideration to be paid by the Council for the transfer of the undertaking (if determined by arbitration) shall be such sum of money as the arbitrators determine to be the fair and reasonable value of the undertaking, having regard to all the circumstances of the case. In ascertaining this sum, the arbitrators may receive all evidence and consider all contentions that may be urged on behalf of the Council and of the Companies respectively as affecting the value of the undertakings, and shall have full power to deal with the same, or any of them, in such manner as they in their absolute unfettered discretion may think fit. But no allowance shall be made for compulsory sale except so far as the arbitrators may award to meet the cost of re-investment.

4.—Council to take power to enter into possession of the undertaking of each Company on or after the date of completion of a financial year of that Company next but one after the passing of the Act, although the purchase-money may not yet have been fixed by the award of the arbitrator, on condition that notice shall have been given to acquire compulsorily, and on condition that the Council pay to the shareholders dividends calculated on the average of those declared in respect to the six half years immediately preceding the publication of the notices for the Bill until the payment of the purchase-money.

5.—Council to take power to agree with the Companies, or any of them, or with any of the shareholders, that the purchase-money, when ascertained, may be paid in the form of terminable annuities or otherwise.

6.—Subsequently to purchase by the London County Council, and until the relations between London and the outside areas in regard to management and supply are settled, the Council, or the Council in conjunction with the Corporation, shall be and continue under the same obligation, and shall have the same rights and powers with respect to the provision and supply of water, as the Companies were under and had immediately before the passing of the Act.

7.—That with a view to the settlement of the questions that may arise between the authorities in the area supplied at present by the Metropolitan Water Companies as to the management of the supply and as to the method and terms on which severance of sources should be effected with due regard to all interests concerned, and for the equitable adjustment of the financial considerations involved, a special Commission should be appointed, if and when the Council shall have entered into possession of one or more of the undertakings of the Water Companies, to hold an inquiry into the whole subject, with power to prepare a scheme or schemes for submission to Parliament for the settlement of the questions between the local and sanitary and other authorities or bodies concerned. That provision for the constitution of such a Commission be made in the approaching session of Parliament.

The individual members of the Sub-Committee did not pledge themselves to approval of each head taken separately; but the above heads of agreement were unanimously adopted by the Sub-Committee as forming, as a whole, a reasonable compromise between conflicting

views, which it was hoped would form the basis of an agreed Bill. We are of the same opinion; and if they had been adopted as a whole with a reasonable approach to unanimity, we should have recommended them to the Council as the basis of legislation for purchase. We regret, however, that this has not been the case; and we have been compelled to consider the subject from a different point of view, though we have availed ourselves of the valuable assistance rendered by the earnest and protracted labours of the Sub-Committee. We recommend "That the Parliamentary Committee be instructed to prepare a Bill or Bills for the purchase of the undertakings of the Metropolitan Water Companies on the following lines." [Here follow the first five heads of agreement, as given above. These are marked (*a*).]

In regard to the authorities which are to control the supply in the Metropolitan water area, we have proceeded on the lines of the settled policy of the Council, and in accordance with the agreements which have in the past been made by the Council with the City Corporation and other authorities, and we recommend—

(*b*) That the Bill or Bills be so drafted as to provide that the Council, acting in conjunction with the Corporation of the City of London, shall be the authority for supplying water within the area of the county.

(*c*) That the clause from the model Bill of the House of Lords, commonly applied in similar cases, so far as it relates to the rights of local authorities beyond the district of a purchasing corporation to purchase the works of distribution and power of supply within their respective areas, be included in the Bill or Bills, together with further clauses authorizing the authorities outside London to take over and administer the entire water supply of their districts, upon such terms as to severance of sources or joint management as may be agreed between them and the London County Council, or, in default of agreement as to severance or terms of severance, to be settled by arbitration on the basis of a fair and equitable apportionment of the undertakings and of the cost of the same, having regard to the present and prospective requirements of the County of London and the districts of the other authorities.

In view of the limited time available, we have instructed the Parliamentary Agent to prepare the necessary notices of such Bill or Bills; and we recommend—(*d*) "That the course taken be approved." We think it most desirable that we should be authorized by the Council to confer with the various county and other authorities outside London, with the object of arriving, if possible, at an amicable arrangement with them; and we accordingly recommend—

(*e*) That, with a view to arriving at an amicable arrangement with the county councils and the sanitary authorities outside London, but within the area of the Metropolitan Water Companies, with regard for the future arrangements for the water supply of the Metropolitan area, the Parliamentary Committee be authorized to confer, if and as they deem fit, with representatives of those bodies.

Sir J. LUBBOCK, M.P., appealed to the Council to postpone the consideration of the report for a week; this course being, he said, sanctioned by the Standing Orders.

The CHAIRMAN ruled that the Standing Orders allowed the discussion of the report to be taken that day.

Mr. M'KINNON WOOD (the Chairman of the Parliamentary Committee) moved the reception of the report. He pointed out that the Committee had taken the best course to reconcile the conflicting views of the Council. It was their duty to put forward a scheme which would redound to the credit of the Council and to the benefit of London; and, under these circumstances, he had been authorized to say that if this compromise of the Sub-Committee could be sanctioned, not as a policy of a party, but as the finding of the Council, it would be accepted not only by the Parliamentary Committee, but by the Progressive party, though it did not in every detail express the views of that party, and though many of the points in it were extremely distasteful to them. They saw, however, that there was a desire on the part of the Moderate party to arrive at a reasonable compromise; and therefore they were willing to make concessions. They recognized that it was only by going forward as a united body that they could hope to settle this matter.

The report having been received,

Lord ONSLOW moved as an amendment to the recommendations—"(*a*) That the recommendation be referred back to the Parliamentary Committee, with an instruction to prepare a Bill for the purchase by the Council of the undertakings of the eight Metropolitan Water Companies, containing the provisions in the first five heads, entitled 'Heads of Agreement,' subject to a provision to the effect that, in the event of the Government passing an Act in the next session of Parliament constituting an authority to deal with the Metropolitan Water Supply, the Council's Bill be read as if such authority had been named in it instead of the Council, and that the obligations involved in any agreements come to under the Bill pass to such authority; and that in the meantime (*b*) Her Majesty's Government be requested to introduce a Bill constituting an authority for the purpose of dealing with the supply of water to the area now supplied by the Water Companies, and pending the final settlement of questions between London and the outside areas, and to appoint a Special Commission to hold an inquiry as to the relations between London and the outside areas, including the questions of extension or alteration of the present area of supply, and as to severance of sources and works, if such should be found desirable in the interests of all parties concerned, with power to prepare a scheme to give effect to such severance, and for adjusting the financial considerations involved." He said his view was that the Council ought not to enter into possession of the water undertakings until it was decided who should be the authority to administer them. He recognized that the Government were desirous that the next session of Parliament should not pass without a settlement of the London Water Question; and he was anxious that this wish should be carried into effect without the necessity of the Government introducing a Bill themselves. If the three proposals before the Council were compared, it would be observed that there was some identity between them; and he therefore proposed to alter the amendment of which he had given notice to such a form as to embody in it the first five clauses in the Committee's recommendation. It was admitted by all that a Bill for the acquisition of the undertakings of the Water Companies ought to be introduced. It was also admitted that power should be taken by the Council to pay for the undertakings—not exactly in hard cash, but, if desirable, by agreement, in annuities. Some members of the Council were appalled by the possible magnitude of the sum they would be called upon to pay; and they had asked for some idea of what would be the amount. With regard to the arbitration clauses, he maintained that the proposals of the Committee and the Sub-Committee were identical with the machinery of the Lands Clauses Act, and were suitable to the settlement of the question. A good deal had been made out of the 10 per cent. awarded in cases under the Act; and it was said that this would make a difference of between £15,000,000 and £20,000,000. But if they looked at the market value of the Water Companies' stock, they would find that 10 per cent. represented something nearer £3,000,000 or £4,000,000. With regard to the question of the authority which should administer the water supply, the Committee proposed the County Council for the county, and suggested that the outside areas should have power over the water in their own districts. This was totally opposed to anything Parliament had ever sanctioned; for it had always declared that the Metropolitan water area must remain one. Did they suppose that, if the Council were entrusted with the control of the water supply, the people of London would be content with the present system of assessing water-rents on rateable values? He did not think they need consider the contingency of bringing water from Wales, as such a scheme was not likely to be sanctioned by Parliament. By severing their connection with the outside areas, they would be giving up altogether the greater portion of their supplies; and, in his opinion, it was little short of suicidal to give up so splendid a heritage. They were prepared recklessly, under the Committee's proposals, to sell for an old song all the sources of supply which they admitted to be pure, and which in forty years would give them a magnificent return for their outlay. Of all the proposals that had ever been put forward in the craze for a County Council dominion, this was the most profligate throwing away of the ratepayers' money. Success under the Committee's scheme could only be shown to be possible upon figures which were admittedly inaccurate. Yet they were prepared, knowing well that the House of Commons would refuse to entrust them with the administration of the water supply, to waste the money of the ratepayers in the promotion of yet another Bill harassing and attacking the Water Companies. The Moderate party were the representatives of those who paid the rates; while the members of the Progressive party depended to a large extent for their return to the Council upon those who had their rates paid by other people. It was a small matter, therefore, if the experiments of the Progressives were financially disastrous, so long as there was work—plentiful, light, and well paid—at their command. Did they wonder that the Moderates preferred to see this great question and its far-reaching effects submitted to the careful consideration of a separate and independent body, such as a Commission, which would take all points into account with the one object of deciding it in the true interests of the public weal?

Mr. BEACHCROFT seconded the amendment. He said he regretted the failure of the compromise. The rock on which they had split was the question of what authority should administer the water undertakings after purchase; and it would hardly be creditable that they should run the risk of another year's delay in so urgent a matter because of this one question of disagreement.

Mr. STUART, M.P., said the amendment did not confine itself to the subject of the future authority, but brought back the whole of the discussion to the terms of purchase—the question which had wrecked the Council's Bills last year. There never was such a proposal as the one contained in the amendment—that a body of representatives of several millions of people, having to make a purchase of water undertakings and create a debt, should, by its own act, allow another body to be created to which should be handed over the whole power of purchasing these undertakings by agreement and paying what it chose for them—in fact, to hand a blank cheque to a body about the constitution of which they knew nothing. The amendment was of such a character that he could not for one moment agree to it. The Government killed the Council's Bills last year because he would not accept what he believed to be too heavy compensation to the Water Companies; and now they were to ask the Government to create a body which was free to purchase the water undertakings by agreement, apart altogether from the question of arbitration. This was not a condition of things which they ought to accept; and he therefore asked the Council to reject the amendment.

Lord FARRER said he thought the Sub-Committee might congratulate themselves that they had carried agreement farther than they had ever done before. They were all now agreed that there must be purchase; and there was further agreement as to the terms of purchase. The real difference was that Lord Onslow's amendment rejected almost entirely the notion that the existing local authorities should be entrusted with the management of the water supply. He would ask whether this indicated a desire for progress in municipal government. He felt convinced that the only way of settling this question was for the London County Council and the different authorities outside London to enter into friendly negotiations, and make arrangements between themselves. The Government had plenty before them to do in the coming session. Water, as they knew from history, was a fatal subject with the Government. Let the Council therefore free the Government from a great difficulty and responsibility by trying to make arrangements with these outside bodies, and so prevent the necessity of their coming in with the master-hand, and saying how all their local concerns were to be managed. He objected to the principle rather than the terms of Lord Onslow's amendment; and he should certainly vote against it.

Lord MONKSWELL was in favour of compromise; and he expressed the hope that, even at the eleventh hour, those who were standing out would come in.

Mr. HARRIS said that, if it would settle the water question, he could see no abject humiliation in the Council approaching Parliament in the way suggested. The recommendations of the Parliamentary Committee were simply reproductions of the suggestions placed before Parliament last year and rejected. Lord Onslow's amendment proposed what was really a large part of the compromise—that the question of authority, upon which there was a direct issue, should be referred to a Special Commission. He should support the amendment as including the maximum of agreed points.

Mr. CORNWALL said the Progressives had made every possible concession in their desire to secure agreement in this matter. They were quite prepared now to adhere to the "Heads of Agreement" which formed the compromise. The effect of carrying the amendment must be to immediately raise the value of the Water Companies' shares, and indefinitely postpone the purchase of their undertakings.

Mr. DICKINSON opposed the amendment. He stated that the party with which he acted felt deeply that the County Council were *primâ facie* the body to move in the matter of the water supply; the Council having the future of London government in their hands.

After some further discussion, a division was taken on the amendment, which was lost by 59 votes to 48.

Lord MONKSWELL had given notice of an amendment—"That all the words after the word 'Companies' be omitted, and that the following words be inserted: 'on the lines of the compromise hereinbefore set out';" but he declined to move it.

The Hon. L. HOLLAND, M.P., said he would do so.

Mr. MARKS, M.P., seconded the amendment.

Mr. M'KINNON WOOD said he was prepared to accept the amendment on behalf of both parties, on the condition that it was supported by the majority of the Moderate party.

Lord ONSLOW said that, his amendment having been defeated, they were face to face with two alternatives, neither of which he could agree with as a whole; but it was to the recommendation of the Parliamentary Committee that he took the greatest and gravest objection. If he were called upon to decide between the two, he should vote for Mr. Holland's amendment; it being distinctly understood that, in doing so, he did not pledge himself to the County Council being the Water Authority, but reserved to himself full liberty, in future stages of the Bill, to criticize and oppose the proposal.

Mr. GOULDING, M.P., announced that he would not pledge himself to support the Bill in Parliament or elsewhere.

Mr. STUART remarked that, after Lord Onslow's statement, it would be absurd to say there was unanimity in the Council; and it would be useless to go forward with the compromise as the agreement of all parties. He should accordingly vote against the amendment.

The Council then divided, and there voted—

For the amendment, 31; against it, 70—majority against, 39.

The CHAIRMAN then proceeded to put the recommendations of the Committee in their order. On recommendation (*a*) a division was taken; and it was carried by a majority of 48. On recommendation (*b*) another division was taken, with the result that it was carried by a majority of 14. Recommendations (*c*) and (*d*) were carried without divisions; but a division was taken on the last recommendation (*e*), with the result that it was carried by a majority of 21.

The Examination of Water.

In a letter to "The Times" last Tuesday, Dr. Dupré replied to Dr. Percy Frankland, who, as mentioned in the "JOURNAL" last week (p. 923), had defended the present system of water examination, and criticized the conclusions arrived at by the Council's experts. With regard to Dr. Frankland's statement that Dr. Dupré had asserted that "some of the filtered samples of water he examined contained as many bacteria as the unfiltered water," the latter replied that what he said in his report was that the number of organisms varied from 28 to more than 5000 per cubic centimetre; and he then continued: "Taking the number of organisms permissible in a drinking water at 100 per cubic centimetre, as fixed by Professor Koch, not less than 35 out of the 64 exceeded this limit; while 8, and probably 11, contained 1000 and upwards in the same quantity. Indeed, in a few samples the number is as high as in some unfiltered river water, although in the majority of cases it is far smaller." This, he pointed out, was altogether different from Dr. Percy Frankland's version. He went on to say: "If Professor Frankland will read the monthly report made to the Local Government Board by an expert whose authority on such matters is, if this be possible, higher than his own, he will find that the unfiltered river water at Hampton is reported not unfrequently to contain a number of organisms below, and even much below, 5000 per cubic centimetre. This, of course, is what I alluded to in the above quoted sentence. . . Expert opinion is now practically unanimous as to the unfitness of the unfiltered waters of the Thames and Lea to serve as a supply of drinking water to the Metropolis, on account of the possible danger to health involved. If this be so, the safety of the supply depends entirely on the perfection with which the necessary purification is carried out by the various London Water Companies before the water is supplied to their customers. The advocates of the river supply assert that their system is so perfect that no danger is to be apprehended. The opponents, on the other hand, while fully acknowledging the general excellence of the supply, are of opinion that it is practically impossible to guard absolutely against an occasional breakdown of the filtering arrangements, and are, on this account, of opinion that the health of a town like London should not be left to depend on arrangements which are, even if but rarely, liable to break down."

The same issue of "The Times" contained an article on "The Purity of London Water," in which the reports of Mr. Dibdin and the Council's Chemists were criticized, and their anomalies pointed out. In the course of his remarks, the writer suggested that these might be accounted for by the method of collecting the samples. In a letter in reply last Thursday, Dr. Klein stated that the method in question was determined, after consultation, by Mr. Dibdin, Dr. Dupré, Dr. Stevenson, and himself. The collection was made at the various hydrants by an expert, in clean bottles, with the utmost precautions, and the samples were delivered to his laboratory in the speediest manner practicable. The question he had to answer was, what was the state of the water, not immediately after it passed the Companies' filters, but immediately before it was delivered to the consumer—that is to say, in the mains; and his report showed that the condition of the water as delivered was certainly different from what one would have supposed from the reports made by the Companies' Analysts. With regard to the nature of the bacteria, Dr. Klein stated that in his experiments *bacillus coli* were found in considerable numbers, on ten occasions, in the waters delivered by the Companies drawing their supply from the Thames and Lea. This result was obtained by submitting to examination by suitable methods a large volume of the water (1200 c.c.). If the examination were made with 0·1 c.c. or even 1 c.c. of the water, the above result could not have been obtained. He acknowledged that some of the highest authorities had not yet availed themselves of the method of submitting large volumes of water to bacteriological examination; but he had little doubt that when they did so, and when they extended their investigations to the water just antecedent to its delivery to the consumer, they would find that it occasionally harboured the *bacillus coli*, and not unfrequently living animalculæ.

In their last monthly report to the Water Examiner for the Metropolis (Major-General A. de Courcy Scott, R.E.), Professors Crookes and Dewar, the Water Analysts for the London Water Companies, make the following remarks on the subject of the controversy on the quality of London water: "Our chemical and bacteriological results have recently been submitted to severe criticism in a report published by the London County Council. This is not the place, neither would time allow us, to answer it in detail; but we cannot neglect the duty of correcting one or two of the most glaring mistakes. In order to account for the alleged enormous bacterial contamination of the London supply, and therefore to condemn the efficiency of the treatment of the water by storage and filtration in opposition to our previous statements and results, the report declares that we do not conduct the bacteriological examination in a proper manner. The facts are exactly the opposite of what the report assumes. It is the mode of collecting and keeping the samples previous to the bacteriological examination, adopted by the reporters to the London County Council, that is unscientific. We rigidly follow the bacteriological methods of the originator of the process—namely, Dr. Koch, of Berlin—in the collection and treatment of the samples and in the plate development. Our results have for months been confirmed by the independent examinations of Dr. Edward Frankland. To get results entirely at variance with ours, the samples must have been treated in an unscientific way for the purposes of such investigation. As to the 500th part of a grain in the gallon of suspended matter in the London supply, this need cause no scare. No natural or artificial filtration can avoid causing some amount of suspended matter. No supply from Wales, which must be subjected to chalk treatment and filtration before it could be supplied to London, could avoid containing as much, if not more, suspended matter; so that Londoners would in such future supply still have to consume 67·5 tons of peaty mud per annum. Our samples for bacteriological investigation contain all the suspended matter; and as long as the results show the relatively small proportion of microbes that our specimens have done, the public need not doubt the wholesome quality of the present London supply, and may safely discard the 500th part of a grain per gallon of innocuous material in the form of suspended matter. It cannot be disputed that, in spite of all the allegations of increasing contamination in the valleys of the Thames and Lea, the water supplied to the Metropolis has improved during recent years, instead of deteriorated; and with increased storage and effective filtration, we do not doubt the present sources will continue to furnish a supply adequate in every way to the needs of the Metropolis."

"Times" Correspondence on the Water Question.

In a letter in "The Times" for the 2nd inst., Mr. H. Clarke, when discussing the London Water Question, referred to Sir John Lubbock's views on the subject—or, as the writer put it, his "championship of those opposing purchase;" and he expressed a wish that "someone would demonstrate, by facts or figures, that the management of the water supply by the people for the people—first, would not ensure a more plentiful and potable supply than we are justified in expecting from commercial companies, whose main object must be to make profits; secondly, that consumers of water would not enjoy a prospect of obtaining relief from the various vexatious charges to which they are now subject by the Companies; and, thirdly, that they would not eventually derive advantage from the profits, now enjoyed by the shareholders, being diverted to the Water Board." He added that it was also desirable that those opponents of purchase who are in favour of "control" should formulate precisely the system they propose, as no one had ventured to do this. Sir John took up the challenge, and sent to "The Times" a long letter which appeared on Monday last week. With regard to the first point—that the management of the water supply by a public body "would not ensure a more plentiful and potable supply"—he said it was for Mr. Clarke to prove his case, and not for him (Sir John) to disprove it. However, he confessed that he was one of those who believe that, as a rule, private enterprise is better than public management. He cited the case of the East London Water Company in support of his views. The Company foresaw the danger of scarcity of water, but the power to prevent it was denied by the London County Council. And yet this very scarcity was used as an argument for taking the supply out of the hands of those who proved to be right, and handing it over to those who proved to be wrong. Passing on to the second point—that purchase by open arbitration would not be financially advantageous—Sir John reviewed the position of the water question at the time of the late Mr. E. J. Smith's negotiations in 1880, and showed, by figures arrived at by the London County Council, that the rejection of the purchase then proposed had, so far from placing the public in a worse position, saved them more than £1,000,000. Considering the probable results in the future, Sir John said: "The total value of the Water Companies' stock in November, 1895, in a report made by the Comptroller, is given at £35,400,000. It can hardly be supposed that this could be acquired without any compensation for compulsory purchase. Let us take the probable cost at £37,000,000. The Metropolitan stock we know pays 2½ per cent. per annum. But to this must be added the expenses of management. These may be taken at a shade over ½ per cent. So that we may take the cost to the ratepayer, which is the real figure we have to consider, at 2¾ per cent. The net profits of the Companies are £1,170,000, or a shade over 3 per cent. on £37,000,000. This would leave a margin of little more than ¼ per cent., which is surely not sufficient to indemnify the ratepayers for undertaking so gigantic a responsibility, even if the expenditure under public management were as economical, which experience

shows would certainly not be the case. Moreover, I should like to ask whether it is intended to buy up every business which pays 3 per cent.; and, if not, why not? Bread is necessary as well as water; and bakers make far more than 3 per cent." Sir John went on to show that there are several other points to be considered, three of which, at least, are of vital importance to the existing ratepayers. He set them forth as follows: "In the first place, it may well be doubted whether we could double, or more than double, our Metropolitan debt without raising the rate of interest. But if there were a rise of even ¼ per cent., this on a debt of £70,000,000 would cost us £175,000 a year. The second consideration is that of amortization. It is the wise policy of Parliament that municipal loans should be gradually redeemed. The longest time allowed us is sixty years. To redeem £37,000,000 in sixty years would require £280,000 a year, and would raise our rates, therefore, 1¾d. in the pound. This would fall very heavily on existing leaseholders. Lastly comes the question of future supply. The Companies are bound to provide water sufficient in quantity and of standard purity. The increase of population in the valleys of the Thames and the Lea renders it gradually more and more difficult to maintain the purity of the supply; and the majority of the London County Council, as well as our skilled advisers, are of opinion that it will be necessary to bring a supply of purer water from a distance. The Royal Commission considered that a sufficient amount might be secured by the formation of immense reservoirs. The Welsh scheme would probably cost some £30,000,000. The reservoirs would, perhaps, be a few millions cheaper; but the supply would be less satisfactory. It is evident that the interest on the capital required by either of these schemes would be very large; and, in the words of the report of the London County Council Water Committee of 1881, 'It is no exaggeration to say that London might in this matter be made to pay from thirty to forty millions in purchasing the undertakings of the Companies, and might then find itself obliged to spend from ten to twenty millions more in providing a new supply. This would, in all probability, be the result of an obligatory immediate purchase on arbitration terms; and such a purchase must, therefore, be resisted at all hazards.' The Parliamentary Committee of the Council shared these views." Sir John quoted from reports by that Committee and the Water Committee, as well as a memorandum by the then Deputy-Chairman (Mr. W. H. Dickinson), to show that, if even £30,000,000 were paid for the property of the Companies, it would involve an increase of at least 30 per cent. in the water-rate—he individually believed it would probably be several millions more. Passing on to deal with the prevailing tendency of public opinion in favour of placing the supply of water in the hands of the County Council, Sir John expressed doubts regarding the wisdom of this step. The advocates of purchase recommended it, he said, because it would "leave a large profit to go in relief of the rates." This was a tempting proposal. But it did not rest on solid ground; and the probable effect would be the very reverse. He quoted Lord Farrer and Mr. H. Burdett in support of his views on this point. Answering the challenge to define what form the "control" recommended should take, Sir John said the plan he would adopt would be that followed in the case of some of the great Indian railways. He then proceeded as follows: "The London Water Companies (with perhaps one exception) are limited to a 10 per cent. dividend. When they have received this, they are bound to reduce the price of water. They have, however, the right to make up back dividends to 10 per cent.; and this, in any definite arrangement, should be limited to a certain number of years—perhaps six, as was done in the corresponding case of the Gas Companies. At present four of the Companies are paying 10 per cent., and three more are very nearly able to do so. Perhaps, however, the simplest way of regarding the case is to take a single Company. Look, then, at the West Middlesex. It is paying its maximum dividend—the shareholders are entitled to no more. If the profits increase, the Directors are bound to reduce the price of water. Indeed, they have already done so to some extent. In fact, therefore, the so-called shareholders are preference shareholders. The ratepayers have a valuable property in the Company. Any additional profit already belongs to the ratepayers; but the shareholders have a responsibility from which purchase would relieve them. Why, then, should the ratepayers buy? Any additional profit is theirs already, while any deficiency would fall on the shareholders. In preference to purchase, therefore, I suggest control. This would require a Bill for carrying out the following objects: (1) To limit the right to back dividends within reasonable limits, as has been done in the case of the Gas Companies. (In the case of these Companies, it was fixed at six years.) (2) To place on the Board of each Company representatives of the London County Council and of any outside district interested. (3) In the case of the Southwark and Vauxhall Company, the maximum dividend must be reconsidered. In this way, all question of price will be avoided. We shall leave on the Companies their present responsibilities; and all conflict with the outside authorities would be avoided." This arrangement would, Sir John thought, be fair to the shareholders, because they would escape litigation and gain security. On the other hand, the public would be spared from the immense outlay which might be necessary to secure an additional supply; and they would avoid taking a gigantic risk, while, if the profits should increase, the balance would have to be applied in reduction of the water-rate.

On Thursday, the Hon. Lionel Holland, M.P., who has given considerable attention to the Metropolitan Water Question, as testified by his public utterances on the subject, and an able article in the current number of the "National Review," had a long letter dealing with the points brought forward by Sir John Lubbock. Mr. Holland does not dispute Sir John's proposition "that, as a rule, private enterprise is better than public management." At the same time, he thinks that, while it is objectionable for public to compete with private enterprise—for a public body to employ their credit to prejudice the business of private traders—where direct competition, as in the case of the water supply, is forbidden or impossible, there can be no economic objection on principle to an undertaking being vested in a municipal authority or a Government department. Dealing with Sir John's remarks on the question of the expense of purchase, Mr. Holland reminded him that the period for the redemption of municipal loans is sometimes extended in the case of large municipalities acquiring water undertakings—Sheffield, for example, being allowed ninety years; and he thinks even a hundred years might be sanctioned. Sir John laid stress on certain reports made to the London County Council, and especially on a memorandum by the former Deputy-Chairman, which Mr. Holland says "certainly presented a lugubrious view of the possibility of purchase by the Council resulting in a profit." But he thinks Sir John attributed altogether undue importance to this document, which it may be inferred "was inspired by a desire to depreciate the value of the Companies' undertakings, so as to establish a case for the punitive provisions of the arbitration clause which the Progressive party then favoured." He goes on to explain that "Mr. Dickinson founded his conclusions on several assumptions which either in themselves are open to criticism or do not apply to the settlement which the Government suggested last session, or to any scheme which would be likely to receive the support of the Conservative and Moderate parties. For instance, besides accepting the view that the redemption period must be one of sixty years only, he assumed that the Thames and Lea will not suffice as sources of supply after the year 1931, and that it will be necessary to seek a new service from Wales at an expenditure involving a sixpenny rate; and he omitted to take into account the certain additional profits accruing from the increased supply due to the growth in population." Though Sir John Lubbock seems to endorse these propositions, Mr. Holland points out that Lord Balfour's Commission did not arrive at any such conclusion as that the present sources would be exhausted by 1931. What they decided was that it was necessary for them to put some limit upon their inquiries. This limit they fixed at the year 1931; and they reported that up to 1931 the Thames and Lea, subject to the construction of reservoirs at Staines, would satisfy all possible demands. He thinks that there is no reason to doubt the general accuracy of the view of the Commissioners upon the adequacy, subject to the construction of additional works, of the present sources to meet future requirements. Mr. Holland admits that purchase, under the conditions hitherto advocated by the Progressive party in the London County Council, would be likely to result in financial disaster. Dealing with Sir John's doubts as to the tendency of public opinion being in favour of purchase, Mr. Holland shows that "from the year 1850 up to now, every public inquiry that has been instituted has come to the conclusion that the water supply should be vested in some public authority." As to Sir John's proposed system of control, he considers that its adoption would leave all the practical evils of the existing method just as they are. These evils would, he thinks, be remedied by placing the water undertakings in the hands of a public authority. He admits that its constitution, and the area over which it should have control, form another and, no doubt, a difficult question; and he is of opinion that it is one which could probably be best solved by appointing a Commission, either itself to undertake the management of the supply, or to advise Parliament upon the authority or authorities to whom the control should be entrusted, as well as upon the financial considerations involved.

On the following day, Mr. George Livesey joined in the discussion in a short letter which we reproduce: "When Mr. Lionel Holland says that 'where direct competition, as in the case of the water companies, is forbidden or impossible, there can be no economic objection on principle to an undertaking being vested in a municipal authority,' he forgets that there is, as is proved in the case of gas, an alternative system which is equally applicable to the water supply. I refer to what is known as the sliding-scale, which avoids the evils of open competition, and secures in a better way its advantages. It makes the suppliers and the consumers partners, giving the former a direct pecuniary interest in supplying the latter at the lowest practicable price—a small increase of dividend being authorized for every reduction of price, while an increase of price entails a reduction of dividend. The present system, by which, when the maximum dividend is reached, all additional profits must go in a reduction of price, although it has succeeded to a certain extent in the case of the West Middlesex Water Company, utterly failed with the Gas Companies. Most of them were paying maximum dividends; and there was then no further inducement to improvement. But the introduction of the sliding-scale twenty years ago has changed all that. I think Sir John Lubbock, in his most able letter, entirely proved his case. It is quite out of the question to suppose that municipal management can be so effective or so economical as private enterprise, under proper conditions and regulations which can be imposed by Parliament in the case of water and gas supply. I feel that the Gas Companies, being amongst the largest ratepayers, have a right to protest against the policy of transferring the water supply to the municipality, which must inevitably increase the rates, and thus impose an unfair tax on the Gas Companies, and in a greater degree on their partners, the gas consumers."

Oriental Gas Company, Limited.—At the ordinary general meeting of this Company to be held to-morrow, the Directors will report that the business of the Company continues to exhibit a steady and moderate increase. The sale of gas has yielded an increase of £2000 more than the rental of the preceding twelvemonth; and the revenue arising from residual products and fittings is larger by £1600 than that of 1894-5. On the other hand, the cost of the coal carbonized has been higher, owing mainly to the condition of the Indian coal market during the war in China. The course of the exchange has been more favourable than in the preceding year, so that the debit in this respect is £2750 less than the corresponding item for 1894-5. Keeping in view the uncertainty attending the state of exchange in the future, the Directors have taken advantage of the present favourable conjuncture to initiate an exchange equalization account, which will be of the greatest assistance to the Company in enabling them the better to meet adverse movements in the rate, the contingency of which cannot be put out of sight. Debentures to the value of £9000 have been paid off during the year. About three miles of new mains have been laid, and 158 additional public lamps erected. The number of private consumers has also been substantially augmented. The balance of the general revenue account (after payment of the interim dividend of 3½ per cent. in June last, and after carrying £2000 to the reserve and depreciation account) is £33,041, out of which the Directors recommend the payment of a dividend of 4½ per cent., free of income-tax, making a total of 8 per cent. for the year, and leaving £19,541 to be carried forward.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On Wednesday, the 11th inst., being the Martinmas term day, the undertaking of the Portobello Gaslight Company became the property of the Corporation of Edinburgh, in virtue of an agreement which was scheduled to the Edinburgh Extension Act of last session. In order that the Company might be able to take the reading of all the meters on one day, the Edinburgh and Leith Gas Commissioners obligingly sent a staff of thirty men, under the command of Mr. W. Bauchope, the Superintendent Surveyor in Edinburgh. In the forenoon, also, several Town Councillors from Edinburgh—among them Bailie Kinloch Anderson, who knows more about gas and gas undertakings, on account of his being Convener of the Works Committee of the Edinburgh and Leith Gas Commission, than probably all the other Councillors in the city—paid a visit to the gas-works in Portobello. The works are small, producing about 32½ million cubic feet of gas per annum; and they will probably after a time be closed, and the gas supply for the district be taken from either Edinburgh or Leith. In the meantime, however, the Corporation are to keep them going; and they are, further, to reduce the price of gas to consumers from 4s. per 1000 cubic feet, the present rate, to 3s., which is the price charged to private consumers in Edinburgh. A meter-hire of 2s. a year will also be abolished. This means that amalgamation with Edinburgh gives an immediate gain to the community of Portobello of over £2000 a year. The Corporation of Edinburgh are desirous to hand over the works to the Edinburgh and Leith Gas Commissioners; and negotiations to this effect are in progress. But I have written upon this already; and there is nothing new to add. On Tuesday next, the Edinburgh Town Council are to hold their second statutory meeting for the adoption of the Burghs Gas Supply Act, when the subject may get an airing.

Though the transfer of the Portobello Company's undertaking to the Edinburgh Corporation has been effected in the most harmonious manner, a difference has arisen within the Company, the exact nature of which has not as yet transpired. All that is known is that application was made to Lord Pearson in the Bill Chamber of the Court of Session on Thursday, on behalf or Mr. A. Scott, one of the Directors of the Company, to have Mr. Thomas Wood, the Chairman of the Company, and the other Directors and the Secretary, interdicted from holding a meeting yesterday to consider a resolution relating to the winding up of the Company. In order to stay proceedings, the technical objection was raised that Mr. Scott had not been summoned to the meeting at which the Directors considered the resolution to be submitted to the shareholders; but the real reason appears to be that Mr. Scott disapproves of the proposed Liquidator, and that he had had no opportunity of stating his objections to him. This seems to indicate that all that is involved is a competition between two gentlemen for the office of Liquidator; and that time is wanted by Mr. Scott in order that he may push the claims of his nominee. There was nothing to have prevented him stating his objections at the meeting of shareholders; but probably he knew that the other man's appointment would have been carried. He managed to get the meeting postponed; and so he will have time to work whatever is in his mind. I can scarcely think that he will succeed in anything, except, it may be, in transferring a portion of the money which should go to the shareholders into the pockets of the lawyers.

I suppose that nearly everyone who reads these "Notes" is agreed that gas managers, considering the onerous nature of their duties and responsibilities, should be well paid; and further that at present many of them are far from being sufficiently remunerated. If there were, then, a movement for improving the position of gas managers, there would be reason for congratulation; but I am afraid the tendency is the other way. The young gas manager of the present time is, in respect of learning and mental equipment, in a more advantageous position than were those who were appointed in the earlier days of the gas industry; and he should therefore command a better salary. Judging by recent appointments, those who have the control o gas undertakings seem bent on securing young men of talent, but not on paying salaries commensurate with those talents. The case in point just now is Dundee, where Mr. W. M'Crae was lately appointed. A Special Committee of the Dundee Corporation sat on Thursday to consider as to Mr. M'Crae's duties and emoluments. They unanimously resolved that Mr. M'Crae should have no emoluments whatever except salary, and that he should not have the use of the house at the works, with free coal and gas as perquisites. Well, as to that, opinions may differ. It is certainly the simpler way to pay a salary, and be done with details of remuneration which may give trouble in passing through the books. But, on the other hand, there is an advantage in having the gas manager resident near the works. As to giving him free coal, there may also be an advantage in that, in respect that he might be able to experiment with coal under his domestic roof in a way he would not be disposed to do had he to bear the cost of his experiments. The same might be said of his use of gas. He might be disposed to try the effect of various methods of lighting if he had free gas, which he would not do if he were treated as an ordinary consumer. In this way, though his consumption of both coal and gas might look high, there might in reality be no waste, but an actual profit to the undertaking. However, if the salary were made sufficient, I dare say there would be no cavil on these points. The Committee further resolved that no assistant manager should be appointed; but that provision should be made for the works being managed by the chief foreman and clerk during the Manager's absence. This, again, was done in the supposed interest of economy; but it is a detail which concerns themselves more than the Manager. If they are satisfied that the works can be looked after by a foreman and clerk during, say, the illness of the Manager, or during his holidays, the affair is theirs—the Manager would be only interested in so far as the results of his year's working might be disturbed by inefficient supervision when he was absent. Having agreed to these conditions, the Committee took up the question of what salary they were to pay. On this subject, the Clerk submitted the results of his inquiries as to what emoluments are given to gas managers in other towns. I do not give these; but I may point out that Aberdeen was the only place mentioned where a salary is paid in full of everything. The salary there, however, is a much better one than the Committee agreed to recommend; and this, too, though the output of gas is 80 million cubic feet a year less than in Dundee. In Dundee, also, the Gas Manager works up residual products, and takes charge of the public lighting of the town; neither of which duties are performed by the Manager in Aberdeen. Taking these things into account, it might have been expected that the Committee, looking upon Aberdeen as the town which comes nearest to their own case, would have agreed upon a salary somewhat similar—not necessarily of the same amount, because Mr. Smith's experience in Aberdeen is of great value to his Corporation, whereas Mr. M'Crae has in great part to acquire his. But instead of that, they are proposing to give a much lower salary, and one which is less than is paid in Greenock, where the output of gas is not half the quantity it is in Dundee. One proposal was made that the salary should be £350, and another that it should be £450. A division was taken in the Committee, when the latter figure was agreed upon by a majority of one vote. This sum will therefore be recommended to the Town Council. The subject having still to run the gauntlet of the Council, it may yet be modified; but I shall be surprised if there be any proposal to increase it. I feel inclined to say that the Corporation are not acting becomingly in seeking to lower the status of one of the most important of the offices at their disposal; and that if they have any pretension to business capabilities, they ought to reconsider this decision of their Committee.

As I mentioned last week, the Town Council of Dundee on Monday discussed the proposal by Treasurer Ritchie to promote a Bill in Parliament; the chief object of which will be to give additional borrowing powers to the Council in connection with their gas undertaking. There was considerable discussion on the subject. Treasurer Ritchie said it was well enough known that they were stinted for room in the gas-works, so far as producing power was concerned. If they were to cope with the demand for their gas, they would require either larger holders or, as had been suggested, carburetted water-gas plant, which could be provided at very small cost. Mr. Ballingall said they had only storage capacity for 2½ million cubic feet of gas; whereas they sometimes sent out 3½ million feet in one day. On the side of the opposition to the proposal, the only argument of any weight which was used was that, though they had exceeded their borrowing powers a year ago by £21,000, this sum had now been reduced to £14,000, and in a few years it might be wiped out altogether; and that what they were doing was employing their sinking fund as working capital, which was the best use it could be put to. In the end, the Council resolved, by 18 votes to 9, to proceed with the Bill.

It was reported to the Perth Gas Commissioners this week, by Mr. A. Wilson, the Manager, that there had been an increased output of 1,745,700 cubic feet of gas in October last, as compared with the same month of last year; the increase being equal to 15·52 per cent. A Special Sub-Committee who, along with the Manager, had visited a number of places to procure information regarding labour-saving appliances in retort-houses, presented their report. The Committee visited Beckton, Richmond, West Bromwich, Salford, and Burnley. They saw mechanical appliances at work, and also retorts on the inclined system. They considered the inclined system the best; but there was an objection to it—viz., that the Corporation of Salford were at present engaged in a lawsuit for alleged infringement of patent. The Committee were favourably impressed with the manual machine system; the saving in wages by which was much the same as by the inclined retort system—about 1s. 10d. per ton of coal carbonized, which would amount to about £1000 a year in Perth. The report has not yet been considered.

Of municipal appointments which have been made this week, I observe that Bailie Wright has been re-appointed Convener of the Works Committee of the Perth Gas Commission; Bailie M'Hale has been re-appointed Convener of the Gas Committee of the Hamilton Town Council; Bailie Currie has been appointed Convener of the Corporation Gas Committee in Dumfries; Mr. Jarvis has been appointed Convener of the Works Committee of the Arbroath Gas Corporation; Mr. Shanks has been appointed Convener of the Kilsyth Corporation Gas Gommittee; and another Mr. Shanks has been appointed to the similar office at Denny.

In Oban the price of gas is at the abnormally high figure of 7s. 6d. per 1000 cubic feet. Some of the leading citizens are, in consequence, casting about for a water-power scheme to produce electricity, to provide light for the burgh. A representative from Glasgow of a Huddersfield firm who have patented apparatus for the production of acetylene gas, was also in the town the other day; and he gave an exhibition of the gas by means of a small generator, which, it was represented, was capable of sustaining a 50-candle light for six hours. The exhibition excited great interest in the town.

At the Dumfries Gas Commission, on Thursday, Mr. Bowron tabled a complaint as to the bad quality of the gas which was being supplied. It was admitted that for some time the gas had not been so good as the Committee would have liked to make it; but it was explained that they had material on hand which they required to use up, and which did not make such good gas as might have been desired. It was also stated that mains which were laid to deal with an annual consumption of 30 million cubic feet, were now carrying 70 million cubic feet a year; so that the distributing plant was being overtaxed. One member pointed out that he opposed, at the time, the reduction in the price of gas; but he was unsupported, because they wanted gas cheap. They could not, however, use cannel coal at 33s. per ton unless they made the price of gas 5s., instead of 3s. 6d. per 1000 cubic feet. The discussion came to nothing; but it probably served the purpose of enabling the gentleman who introduced it to say something which would keep him before the public.

An interesting ceremony took place last Monday afternoon, at Loanhead, Midlothian, when the extended works and the new gasholder of the Loanhead Gaslight Company, Limited, were formally inaugurated. The Company was formed a short time ago to acquire the undertaking of Mr. W. Kay, a plumber in the town, by whom the gas supply had been furnished. The capital is £3000, in £5 shares; and the Secretary Mr. Sanderson, W.S., of Edinburgh. The extensions at the works have been carried out from the plans of Mr. F. Scott,

Scott, of Galashiels, under the superintendence of the Manager, Mr. J. Tulloch. The new holder, which has a storage capacity of 200,000 cubic feet, as compared with 3000 cubic feet provided by the old one, has been erected by the Barrowfield Iron Company, Limited, of Glasgow. The tank is formed of cast metal plates, and is 40 ft. 9 in. diameter and 16 feet deep. Each tier of plates has a strong iron hoop round the centre. The framing consists of five massive columns, with guides cast on the face, and surmounted with airy lattice girders. The inlet and outlet pipes are 8 inches in diameter. A new station meter has been erected with 6-inch inlet and outlet pipes, and all the necessary bye-pass valves, &c. A 6-inch governor by Messrs. J. Milne and Son, Limited, has also been fixed. The meter and governors stand contiguous to one another, in a new building erected for the purpose. The original tank is to be at once converted into a tar and liquor reservoir; and its dimensions will enable the Company to store a year's make, if necessary. Considerable alterations to the buildings and pipes inside the works have been carried out. At the opening ceremony, at which there was a large attendance, the Chairman of the Company (Mr. J. P. Gibson, of Edinburgh) sketched the history of the undertaking, and assured the inhabitants of the district that the Directors intended to employ the most approved methods for supplying the best quality of gas at a moderate price. Ex-Provost Brown expressed the thanks of the ladies and gentlemen present for the opportunity which had been afforded them of viewing the new works; and said that, with such men as there were upon the Board of the Company, he felt the success of the concern was assured. Mrs. Brown then turned the gas into the mains, amid cheers; and the ceremony concluded with votes of thanks.

The Huelva Gas Company, Limited, which was formed in September, 1878, chiefly for the purpose of lighting the town of Huelva, in Spain, with gas, is a Scotch Company, having its registered office at No. 115, St. Vincent Street, Glasgow. The Company at its commencement, acquired from Mr. W. Simpson, of Glasgow, a concession which had been granted to him by the Ayuntamiento of Huelva, for the lighting of the town. They have issued a capital of £25,000, divided into 2500 shares of £10 each, all of which have been paid up in full with the exception of 100 shares, which were issued as fully paid up, as part price of the concession. For some reason which is not stated, but which can be quite easily understood, they wish to undertake the supply of electricity for the production of light, heat, motive power, or any other purpose; and with the object of obtaining powers to engage in such enterprise, they have to-day presented a petition to the Court of Session in Edinburgh, asking confirmation of an alteration of their Articles of Association, which the shareholders agreed to at extraordinary general meetings on the 1st and 22nd of October. Besides their capital, the Company have outstanding £10,000 of 5 per cent. redeemable debenture stock, and other ordinary business debts, which do not, however, exceed £150, and which they undertake to satisfy before warrant is granted under this petition. The Court ordered the petition to be intimated in the usual way, and to be duly advertised; and they allowed eight days for answers to be lodged. The petition shows, for one thing, the ramifications of British commercial dealings; but it is also curious in this respect, that no account whatever seems to be taken of what the Spanish authorities may think on the subject. It seems most strange, at first sight, that a Scotch Court should have power to sanction a new departure in business by a company working in Spain. Of course, the proposed change is to enable the Company to keep right with those who have invested their money in the undertaking; and any works they may erect must conform to the regulations laid down by the Spanish authorities. But, on the other hand, the proposal involves a change of the ground upon which the Company stands sufficiently great to, it might be supposed, justify some Spanish authority having something to say about it. Apparently this is not so, however, or the Company think it is not.

At the last meeting of the Glasgow Town Council, sitting as the Corporation Gas Commissioners, there was submitted a minute of the Finance Sub-Committee, in which it was recommended that a donation of £120 be made to Mrs. Connor in connection with the gas-poisoning case in Moncur Street, Calton. It was remitted back to the Committee for reconsideration. Since then the matter has again been before the Committee, with the result that it has now been agreed to recommend that the amount to be given to her, for herself and her daughter, shall be increased to £200.

At a recent meeting of the Finance Sub-Committee of the Glasgow Corporation Gas and Electric Lighting Department, the Treasurer (Mr. J. Fleming) reported that the gas-rents collected for the financial year 1896-7 amounted, up to the 30th of September, to £6518, as compared with £6221 at the same date of last year; thus showing an increase of £297. The Treasurer also reported that the revenue derived up to that time from the sale of residual products amounted to £28,897, as against £27,120 at the corresponding date of last year. There was thus an increase over the four months from June to September of £1777.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 14.

Sulphate of Ammonia.—The activity noticed in the last report has continued throughout the week; culminating in an advance of about £1 per ton from the lowest point touched in October—the quotation being £7 17s. 6d. per ton Leith, £7 18s. 9d. Hull, and £8 1s. 3d. Liverpool, f.o.b. The purchasing has again been largely for "covering" speculative sales; but direct orders have been more in evidence—proving that consumers have now accepted the upward movement as serious. There would also seem to have been a certain amount of buying for an advance on speculative accounts; but this move has been seriously hampered by the very firm attitude assumed by the London and Scotch makers, and the extreme prices now demanded by them. English makers outside London, while marketing most of their ready supplies, decline the temptation to sell ahead at the higher level reached. For January-June £8 15s. per ton is required f.o.b. Leith.

Nitrate of Soda is steady at 8s. per cwt. for fine quality on spot.

LONDON, *Nov.* 14.

Tar Products.—This market is at the moment devoid of any striking feature. There is no business of any great importance being done.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 954).

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	23–25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17⅞–18½	..	4 1 1
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	106–109	−1½	4 11 9
800,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	10½–11	+⅛	4 10 11
100,000	Stck.	26 June	5	Do. 5 p. c. Deb. Stk	102–105	+2	4 15 3
200,000	5	12 Nov.	6¾	Bombay, Limited	7⅞–8⅛	..	4 1 3
40,000	5	,,	6¼	Do. New, £4 paid	5¼–6⅛	+¼	4 6 8
380,000	Stck.	13 Aug.	12	Brentford Consolidated	285–290	..	4 2 9
210,000	,,	,,	9	Do. New	215–220	..	4 1 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140–145	..	3 9 0
159,375	,,	12 June	4	Do. 4 p. c. Deb. Stock.	130–134	..	2 19 9
220,000	Stck.	16 Sept.	11½	Brighton & Hove Original	242–247	..	4 13 1
208,820	,,	,,	8½	Do. A Ord. Stk.	185–190	..	4 9 5
933,500	Stck.	28 Aug.	5	Bristol, 5 p.c. max.	127–132	..	3 15 9
420,000	20	15 Oct.	11½	British	56–57	..	3 18 11
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	22–23	..	5 0 0
71,000	10	,,	8½	Do. 7 p. c.	19–20	..	4 5 0
500,000	10	15 Oct.	6	Buenos Ayres (New) Limited	10½–11	..	5 9 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	103–106	..	5 13 2
150,000	20	15 July	8½	Cagliari, Limited	29–31	..	5 6 5
100,000	10	30 Sept.	6	Cape Town & District, Ltd.	16½–17½	−⅛	3 8 8
50,000	50	3 Nov.	6	Do. 6 p. c. 1st Mort.	57–59	..	5 1 8
550,000	Stck.	15 Oct.	13½	Commercial Old Stock	338–343	−3	3 18 8
165,000	,,	,,	10½	Do. New do.	255–260	..	4 0 9
165,000	,,	12 June	4½	Do. 4½ p. c. Deb. do.	152–157	..	2 17 3
800,000	Stck.	12 June	13	Continental Union, Limited.	278–283	..	4 11 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	220–225	..	4 8 11
51,600	Stck.	28 Aug.	14	Croydon Com'cial A 10 p. c.	315–320	..	4 7 6
163,400	,,	,,	11	Do. B 7 p. c.	250–255	..	4 6 3
535,000	Stck.	28 Aug.	5½	Crystal Palace Ord. 5 p.c. Stk	140–143	..	3 13 5
60,000	,,	,,	5	Do. 5 p. c. Pref.	140–145	..	3 9 0
486,090	10	15 July	11	European, Limited	26–27	..	4 1 6
354,050	10	,,	11	Do. £7 10s. paid	18–19	..	4 6 11
5,746,590	Stck.	13 Aug	12¾	Gaslight & Coke, A, Ordinary	317–322	+7	3 19 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	110–115	..	3 9 7
665,000	,,	,,	10	Do. C, D, & E, 10 p. c. Pf.	305–315	..	3 3 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	147–152	..	3 5 9
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	212–217	..	3 9 1
1,303,000	,,	,,	7	Do. H, 7 p. c. max.	207–212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	305–315	..	3 3 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	172–177	..	3 7 10
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	138–143	..	2 15 11
294,850	,,	,,	4½	Do. 4½ p. c do.	150–155	..	2 18 0
908,000	,,	,,	6	Do. 6 p. c. do.	207–212	..	2 16 7
70,000	10	29 Oct.	6	Hongkong & China Limited	12–13	..	4 12 4

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
3,800,000	Stck.	12 Nov.	12	Imperial Continental	222–227*	+3	5 5 9
376,400	100	1 Aug.	4	Do. 4 p. c. Debs. Red.	100–103	..	3 17 8
473,600	Stck.	13 Aug.	3½	Do. 3½ p. c. Deb. Stk ,,	108–110	..	3 3 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	6–6½	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	108–112	−½	4 9 3
250,000	100	,,	4½	Do. 4½ p. c. Debs.	108–110	..	4 1 10
541,920	20	12 Nov.	5	Monte Video, Limited	16–17*	+½	5 17 8
150,000	5	29 May	8	Oriental, Limited	8⅞–9⅛	+¼	4 6 6
135,000	5	,,	8	Do. New, £4 10s. paid	7⅞–8⅛	+¼	4 7 3
15,000	5	,,	8	Do. do. 1879, £1 paid	1½–2	..	4 0 0
60,000	5	16 Sept.	7	Ottoman, Limited	5–5½	..	6 7 3
420,000	100	2 Nov.	6	People's Gas 1st Mtg. Bds.	102–107	..	5 12 1
500,000	100	1 June	6	of Chicago 2nd Do.	102–107	..	5 12 1
250,000	10	30 Sept.	10	San Paulo, Limited	13–14	−½	7 2 10
5,475,000	Stck.	13 Aug.	5⅝	South Metrop., 4 p.c. Ord.	143–147	..	3 10 9
820,000	,,	15 July	5	Do. 5 p. c. Deb. Stk.	171–174	..	2 17 6
60,000	Stck.	16 Sept.	11½	Tottenham & Edmonton, A	270–280	+5	4 2 3
60,300	,,	,,	8½	Do. B	180–190	..	4 9 5
170,380	10	29 May	10	Tuscan, Limited.	13¾–14½	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	101–103	+1	4 17 1
				WATER COMPANIES.			
746,123	Stck.	26 June	10½	Chelsea, Ordinary	338–343	..	2 19 9
150,000	,,	,,	5	Do. 5 p. c. Pref.	177–182	..	2 14 11
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	160–164	..	2 14 10
175,785	,,	30 Sept.	4½	Do. 4½ p. c. Deb. Stock	162–167	..	2 13 11
1,719,514	Stck.	15 Oct.	7	East London, Ordinary	222–227	+2	3 1 7
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	163–168	..	2 13 7
225,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	105–107	..	2 16 1
700,000	50	12 June	7½	Grand Junction, 10 p.c. max.	113–118	..	3 3 6
295,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150–155	..	2 11 7
708,000	Stck.	13 Aug.	12	Kent	335–345	..	3 9 7
160,000	,,	,,	7	Do. New, 7 p. c. max.	217–222	..	3 3 0
1,043,800	100	26 June	9½†	Lambeth, 10 p. c. max.	267–272	+4	3 9 10
406,200	100	,,	7½	Do. 7½ p. c. max.	225–230	..	3 5 2
350,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150–153	+1	2 12 3
500,000	100	13 Aug.	12⅝	New River, New Shares	418–423	..	3 1 0
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk.	150–155	..	2 11 7
902,300	Stck.	12 June	4	S'thwk & V'xhall, Ordinary	154–159	..	2 10 4
126,500	100	,,	4	Do. Do. 7½ p. c. Max.	148–153	..	2 12 3
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175–180	..	2 15 6
1,019,585	,,	30 Sept.	4	Do. 4 p. c. A Deb. Stk.	148–152	..	2 12 7
1,155,066	Stck.	12 June	10	West Middlesex	318–323	..	3 1 11
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	165–170	..	2 12 11

† Next dividend will be at this rate. *Ex div.

Distillers seem to be well sold, and in some cases oversold. The expected improvement in pitch so far has not taken place. Carbolic acid is quoted firm, and appears to be rather scarce. The quotations for benzol and anthracene keep steady; but there is little new business being done in either product.

Values are as follows: Tar, 18s. 6d. to 26s. 6d. Pitch, 27s. 6d. to 30s. Benzol, nominal, 90's, 3s. 10d. to 4s.; 50's, 3s. Toluol, 2s. 3d. Solvent naphtha, 1s. 6d. Crude, 30 per cent., naphtha, 1s. 2d. Creosote, 1¾d.; liquid, 2¼d. Heavy oils, 42s. 6d. Naphthalene, 65s.; salts, 30s. Cresylic acid, 10½d. Carbolic acid, 60's, 2s. Anthracene, "A," 10½d.; "B," 8½d.

Sulphate of Ammonia has taken quite a refreshing turn for the better. It has advanced in price in a somewhat remarkable manner; pretty clearly showing that dealers have been forced to cover their orders on the prospect of a higher range of prices coming to this long-languishing article. Important business has been done at prices varying from £8 to £8 7s. 6d., less 3½ per cent., according to port and terms of delivery.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position in the coal trade here continues to show steady improvement. All descriptions of round coal are in increased demand, with pits kept going full time, and the hardening tendency in prices well maintained. Most of the West Lancashire collieries have advanced their prices about 6d. per ton; and the higher rates are being got without difficulty. Steam and forge coals are moving off more freely; supplies being now nothing like so plentiful on the market as they have been, with the slight advance in prices obtainable pretty readily. At the pit mouth, best Wigan Arley averages 10s. 6d. per ton; and Pemberton four-feet and seconds Arley, 8s. 6d. to 9s. Engine fuel is in fair request, with supplies rather scarce in some of the better sorts; but ample quantities of common slack are offering in the market. The shipping trade continues active, with 7s. 9d. to 8s. per ton now representing the minimum figures for steam coal delivered at Mersey ports or on the Ship Canal.

Northern Coal Trade.—There has been more activity in the Durham coal trade; but the Northumbrian branch is more depressed. Best Northumbrian coals are dull at 7s. 7½d. per ton f.o.b.; and second-class steam coals are quoted at 7s. 3d. per ton. In the case of Durham coals, there is a better tone in the market. Gas coals are firm; but the deliveries are mainly on old contracts, taken at prices considerably below those now quoted. For single cargoes, rates are about 6s. 9d. to 7s. per ton f.o.b.; but there is only a limited amount of coal now above the heavy deliveries on contract, and the full work of the present time is certain to go on for some weeks. The gas coke trade is finding the effects of the larger production; for though there is a greater household use, stocks in the case of some of the inland gas companies seem increasing. There is no alteration to record this week in prices.

Scotch Coal Trade.—There is an improving demand for coal; and though what are known as the official quotations show no advance, it is well known that prices have in some instances slightly improved. Ell particularly is selling at better prices. At last the wages of the miners have been advanced; the coal masters in Lanarkshire having agreed to give 6d. per day extra. The other districts are expected to follow; and a further rise of 6d. is considered probable. The Lanarkshire masters were led to make the concession by two of the largest coal owners, who are not in the Masters' Association, having granted the advance. The prices quoted are: Main, 6s. 3d. per ton f.o.b. Glasgow; and ell, 6s. 9d. to 7s. The shipments for the week amounted to 158,664 tons—a decrease of 481 tons on the preceding week, and of 937 tons on the corresponding week of last year. For the year to date, the total shipments have amounted to 6,673,689 tons—an increase over the same period of last year of 232,285 tons.

The Quality of West Bromwich Gas.—It may be remembered that questions have lately been raised in the West Bromwich Town Council in regard to the quality of the gas sent from the works, which are under the management of Mr. Thomas Glover. It is satisfactory to record, on the authority of the report of the Borough Analyst, that, in the quarter ending Sept. 30, the gas was found to be above the parliamentary requirements on every occasion that it was tested.

Chertsey Gas Consumers' Company, Limited.—At the annual meeting of this Company to be held next Thursday, the Directors will present accounts showing receipts to the amount of £7471, and an expenditure of £6080; leaving £1391 to go to the profit and loss account, the balance of which is £2352. There was a considerable increase in the consumption of gas in the twelve months ending Sept. 30; and the Company's coal trade was increasingly profitable. The Directors recommend dividends of 11½ and 8½ per cent. on the two classes of capital; being the same rates as before. The new works have been proceeded with; a gasholder of enlarged dimensions has been erected; and other improvements, including extension of mains and additional public lamps, have been carried out, under the supervision of the Manager (Mr. H. Hamilton).

Fletcher, Russell, and Co., Limited.—The fifth annual general meeting of this Company was held in Manchester on Monday last week. The trading account showed a gross profit of £32,951, after writing off depreciation. After deducting Directors' salaries and the interim dividends on the preference and ordinary shares, the balance remaining for disposal amounted to £21,945. The Directors recommended that £5000 should be further written off the property accounts, and £4545 added to the reserve fund, which would make it £14,331. The balance (£12,000) was appropriated in the payment of a dividend on the ordinary shares at the rate of 10 per cent.—making, with the interim dividend at this rate, 10 per cent. for the year—and, in addition, a bonus of 20s. per share on the fully-paid ordinary shares, and 15s. on the ordinary shares on which £7 10s. has been paid; and handing over to the Managing Directors one-third of the surplus profits, after paying 10 per cent., in accordance with the Memorandum and Articles of Association.

RICHMOND & CO., LTD.,

WARRINGTON & LONDON.

THE "DRAGON."

New Pattern. Season 1896-7.

ADVANTAGES:

1. It is **very hot and incandescent** in a few minutes.
2. Most ornamental in design, and **beautifully finished.**
3. **New Duplicate Hot-Air Chamber joined by four tubes,** secures all duty possible from gas consumed, **giving 574 sq. in. of heating surface.**
4. Vaporizing pan at bottom of Stove **overcomes complaint of dry heat.**

PRICES.

1485	**45s.**
1487	**55s.**
1489	**65s.**

The Lighting of Crowland.—In the "JOURNAL" last week, it was stated that the town of Crowland, in Lincolnshire, was to be left in darkness owing to the necessary majority of votes not being obtained for adopting the Lighting and Watch Act. We now learn that some of the inhabitants have come forward with offers of private funds to enable parts of the town, at all events, to be lighted.

Driffield Gas-Works Transfer.—The Driffield District Council resolved yesterday week to apply to the Local Government Board for their sanction to the purchase of the undertaking of the Gas Company for the sum of £22,500, and also for a loan of £25,000, repayable in 40 years. Deducting the purchase money, £1500 of the balance will be required to meet the legal and professional charges, and £1000 will be left for other expenses.

New Issues of Stock.—The East London Water Company are inviting tenders for £165,000 of 3 per cent. debenture stock; being the third portion of the £500,000 of debenture stock created under the Company's Act of 1894. The minimum price of issue is par. The Crystal Palace District Gas Company are about to issue £20,000 of ordinary 5 per cent. stock, at a minimum price of £135 per £100. The Guildford Gas Company are about to issue by auction £5000 of ordinary 5 per cent. stock.

Sales of Shares.—Last Wednesday, six £10 shares in the Bury St. Edmunds Gas Company realized £23 10s. each; three, £24 each; and two, £24 5s. apiece. A parcel of £10 shares in the Ashford (Kent) Gas Company secured an average of £20 each; and another, of £5 shares, £8 10s. each. Some £20 shares in the Leighton Buzzard Gas Company realized £45 and £46 each; while a £14 share went for £30. Last Thursday, 20 fully paid shares of £20 each in the Gravesend Water Company realized an average of £66 each *ex div.*

The Public Lighting of Sowerby Bridge.—On the recommendation of the Gas Committee, the Sowerby Bridge District Council have agreed upon a comprehensive re-arrangement of existing street-lamps and the introduction of several new ones, in order to secure the more efficient lighting of the district. The new lamps (29) will bring up the total number of public lights to 350. The district contains a population of 11,000, and has an area of only 600 acres; and the Council claim that the town is lighted as well as most others of its size.

The Purifier Disaster at the North Shields Gas-Works.—A handsome memorial has been erected to the memory of the brave men who lost their lives by the disaster at the Tynemouth Gas Company's works in January last. It consists of a solid block of Heworth freestone, 11 feet high, and has been worked into shape by Mr. Harvey, sculptor, of North Shields. The memorial has been erected over the graves of the deceased men, to the order of their fellow workmen, who have been assisted in their laudable undertaking by a donation of £10 from the Directors of the Company. This fund is quite apart from that which was subscribed for the widows and orphans, who are still being provided for. The following is a copy of the inscription on the stone: "Erected by the Employees of the Tynemouth Gas Company to commemorate the death of their fellow-workmen, Charles English and John Mains, who, whilst following their employment, were asphyxiated by an escape of sulphuretted hydrogen gas, on Jan. 20, 1896. Also William Vickers, foreman, William Venus M'Guire, and David Taws, who lost their lives in a noble attempt to rescue the above. Also William Brown, one of the rescue party, who succumbed to his injuries at a later period. 'Greater love hath no man than this, that a man lay down his life for his friends.'"

Threatened Strike at the Rotherham Gas-Works.—Some dissatisfaction exists among the men at the Rotherham Gas-Works; but whether on reasonable grounds or otherwise the information to hand is not sufficient to show. However, at a meeting of the men a few days since, one of their number stated that they had been discussing the matter of handing in their notices for some time past; and one of the officials of the men's Union (Mr. A. J. Bailey) mentioned that they were in favour of the abolition of the present system of coal wheeling. They contended, he said, that the work entailed was too laborious, and asked the Gas Committee to put on regular coal-wheelers. Some little time ago, the men desired to meet the Chairman of the Gas Committee with the Manager (Mr. M. Murdock), and after some difficulty, an interview was arranged. The result was that the Chairman promised to lay the question before his Committee, and convey to them the result. This he had failed to do. Since then one of the men had been dismissed without just cause; and consequently it had been decided to take further steps. He had been instructed to see the Manager, and ask for the man's re-instatement; but this the Manager refused to do. It was now for the men to decide what should be done. Eventually a vote by ballot was taken; and it was agreed to at once hand in fourteen days' notices. The dispute, it is stated, affects between 40 and 50 men.

Award to Messrs. Richmond and Co.—At the recent exhibition at Gateshead, Messrs. Richmond and Co. were awarded a gold medal for the excellence of their gas cooking-ranges and gas-fires.

Reductions in Price.—The Directors of the Hartlepool Gas and Water Company have decided to reduce the price of gas 1d. per 1000 cubic feet as from the end of the current quarter; making it 2s. per 1000 feet. The Bristol Gas Company have lowered their price to 2s. 4d. per 1000 cubic feet.

Projected Amalgamation of the New Conveyor Company, Limited, and Messrs. Little and Graham, Limited.—We learn that arrangements are in progress for an amalgamation of the two above-named undertakings. It may be remembered that the senior partner and founder of the latter firm was the proprietor of the New Conveyor Company; and it is now thought that the incorporation of the two businesses will be attended with many advantages.

New Joint-Stock Companies.—The Penzance Gas Company, Limited, has been registered with a capital of £50,000, in £10 shares, to acquire the undertaking of the Company named, to manufacture, sell, and supply light in the town of Penzance and elsewhere, and to carry on the business of an electric light company. The Continental Water and Electrical Power Syndicate, Limited, with a capital of £26,000 in £1 shares, will adopt and carry into effect two agreements; the further object of the Company being sufficiently indicated by the title.

Explosion of Gas at Cambridge.—Further trouble has arisen at Cambridge through the disturbance of gas-mains by sewerage operations. Last Friday morning, a serious explosion took place in the house of Mrs. Flack, in Park Street, by which the premises were wrecked, and the occupier was much scorched and shaken. According to a report which has come to hand, subsidence of the roadway after the making of a new sewer caused a fracture of a gas-main, and the escaping gas found its way into the house and became ignited. About a twelvemonth ago a similar accident occurred, for which the Corporation were held to be liable.

St. Ives Gas-Works.—A statement was made at a meeting of the St. Ives (Cornwall) Town Council last Tuesday respecting the position of the gas-works, which were acquired by the Corporation last year. Alderman Daniel said that, notwithstanding a reduction in the price of gas from 6s. 3d. to 5s. 6d. per 1000 cubic feet, the receipts for the last quarter were £50 in excess of the corresponding period of last year, and 42 new consumers had been added. A trial had, it was said, been given to the incandescent system of street lighting; but the town was so exposed to wind and weather, and the cost of mantles and chimneys was so great, that the experiment was abandoned.

Incandescent Gas Lighting at Hampton Wick and Teddington.—The District Councils of Hampton Wick and Teddington have entered into contracts with the Hampton Court Gas Company to light the public thoroughfares by the incandescent gas system. The present charge for lighting in Hampton Wick is £3 13s. per lamp per annum; and the Company offered to provide and fix incandescent burners for 15s. 6d. per lamp, and supply all mantles and bulbs—the terms to remain unaltered. As an alternative, they offered to reduce the rate to £3 3s. per lamp, and charge the District Council extra for the renewal of mantles, bulbs, &c., on a scale supplied. About twenty new lanterns would be required; and these the Company were willing to provide and fix at 25s. per lantern. The Lighting Committee of the Council recommended the acceptance of the inclusive charge, and estimated the cost as follows: 93 burners at 15s. 6d. each, £75 19s.; 20 lanterns at 25s. each, £25—total, £100 19s. The Company offered to defer payment of this sum till July 1, 1897.

The Gas and Water Profits Question at Widnes.—A Local Government Board Inquiry was held at Widnes last Wednesday, by Mr. E. P. Burd, in regard to an application made by the Corporation for a Provisional Order, under section 303 of the Public Health Act, 1875, "to partially repeal, alter, or amend the Widnes Improvement Act, 1867, so far as the same provides for the application of the gas-works and water-works funds respectively in the payment off of the principal moneys secured by gas-works and water-works mortgages respectively, in addition to setting apart the respective sinking funds for payment off of the said mortgages." There was a large attendance of councillors, in view of the great interest displayed in the question, which was discussed at some length in the Council on the 13th ult. (see ante, p. 752). The Town Clerk (Mr. H. S. Oppenheim) appeared for the Corporation; Mr. Squarey, of Liverpool, for the opponents of the application. The proceedings, a report of which we are compelled to hold over, showed that there is very strong opposition in the town to the proposals of the Council, which would, it was contended, tax the consumers of gas for the benefit of the ratepayers at large.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
JOHN WM. O'NEILL, Managing Director,
Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 800 British Gas-Works.
ANDREW STEPHENSON,
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OLD BROAD STREET,
LONDON, E.C.
Telegrams: "Volcanism, London.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.
JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement see Nov. 3, p. 830.]

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OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. Sample and Price on application.
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120 and 121, NEWGATE STREET, LONDON, E.C.
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FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application.
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GWYNNE & BEALE'S
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HYDRAULIC AND GAS ENGINEERS,

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Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extant of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.
Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
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Offices: Commercial Buildings, LEEDS.
Correspondence invited.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 933, last week's issue.)
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HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

WANTED, by a young Man, a Situation as STOKER in a Small or Private Gas-Works. Used to Shovel Charging. Can be well recommended.
Address MASON, Gretton, near KETTERING.

WANTED, a Gas-Fitter and Meter INSPECTOR.
State Age and Wages required to HAROLD BAKER, Manager, Gas Department, COCKERMOUTH.

TO GAS-FITTERS.

WANTED, a competent Gas-Fitter for a Town in the Midlands. A permanent Situation to a good Man.
Apply, by letter, stating Age and Wages expected, to No. 2745, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

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JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHURIC ACID for Sale (B. O. V. and R. O. V.) made from Spent Oxide.
The EXECUTORS of the Late JOSIAH HARDMAN, Chemical Works, Milton, STAFFS.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

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INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
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THE RELIANCE LUBRICATING OIL COMPANY SUPPLY on APPROVAL "RELIANCE" NON-CORROSIVE LUBRICANTS (which, through their superiority, have the largest sale in the world)—viz., Engine, Cylinder, and Machinery Oils, 11½d.; Spindle Oil, 8½d.; Gas-Engine and Dynamo Oils, 1s. 6d. per gallon; Barrels Free and Carriage Paid. Also Liquids for Gas Making, Enriching, &c.
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Depôts at Liverpool, Bristol, Hull, Glasgow and Newcastle-on-Tyne. Telegrams: "Subastral, London."

SECRETARY wanted for a Public Company. One preferred who has had experience in a Gas-Works or Gas Engineer's Office.
Apply, by letter, stating Experience, also Salary required, to No. 2746, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE BOLTON. Special Attention to Repairs.
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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
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MICHAEL AND WILL'S Law of Gas, Water, and Electric Lighting. Fourth Edition. Entirely re-written by J. SHIRESS WILL, Esq., Q.C. *Royal* 8vo. 1894. *Price* 32*s.*, *Cloth*; *for Cash, post free*, 26*s.* 6*d.* "The Standard book on the subject."—"Local Government Chronicle."
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STEPHEN CARPENTER, late of the Bow Common Gas-Works, on the PURIFICATION OF COAL GAS BY LIME, &c., and the Method of Working Lime Purifiers so that the Lime may be used a second time, with a Description of a short Method of Working the Sulphur Test.
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WANTED, in the Provinces, a first-class GAS-FITTER, with a knowledge of Electric and Telephone Fittings. State Wages required. None but Men with exceptionally good characters need apply.
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WANTED, immediately, a Working FOREMAN to assist in the general routine of a Gas-Works (make about 78 millions), and competent to take charge in the absence of the Manager. Wages 30s. per week, with House, Gas, and Fuel.
Apply, stating Age and Qualifications, with recent Testimonials, to Mr. G. SMEDLEY, Town Hall, BUXTON.
Buxton, Nov. 13, 1896.

REQUIRED at once, a Junior Clerk for a well-established Gas Company in one of the Northern States of Brazil. Age about 21. Three Years' Engagement. First-Class Passage out and home free.
Apply, by letter only in first instance, to No. 2748, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C., stating Qualifications, Salary expected, and Employment for last three Years. Enclose *copies only* of three recent Testimonials.

GAS Coal Firm require Representative, with connection among Gas Engineers. Good opening to reliable Man.
Applications treated in confidence.
Apply, by letter, to No. 2743, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Provincial Gas-Works, a thoroughly efficient CLERK. Age not to exceed 30 years. Must have experience of Coke Cash Sales, Time Book, Fittings, &c., &c. Security for £100 in an approved Guarantee Office required.
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OIL-GAS BENZOL for Enriching Coal Gas. A few Thousand Gallons to dispose of.
Apply, by letter, in the first place, to No. 2714, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Plant, both new and second-hand, ready for delivery, including Retort-Fittings, Condensers, Exhausters, Scrubbers, Purifiers. Meter, Governor, and Gasholder. **Inquire Price and Particulars before ordering elsewhere.**
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COMPLETE GAS PLANT FOR SALE.

TO BE SOLD separately, or in one lot—
One large Double-Lift HOLDER, with Cast-Iron Tank, 46 ft. 6 in. diameter by 16 ft. deep, with Inlet and Outlet Pipes.
Two Double-Lift HOLDERS, 34 ft. 4 in. diameter outer, 32 ft. 10 in. inner, 14 ft. 3 in. deep, with Pipes, &c.
One GOVERNOR, SYPHON BOXES, VALVES, &c.
One STATION METER, with Valves (new), Braddock's make.
One Set of four PURIFIERS, 7 ft. square by 4 ft. deep, Walker's make, with Grids and one of their Centre-Valves, Connections, and Lifting Gear.
One TAR-PUMP and STORE BOILER.
One Eclipse WASHER-SCRUBBER, Laycock and Clapham, with Pulleys and Governor, erected in 1890.
One EXHAUSTER, with 12-inch Valves and Connections.
One Horizontal CONDENSER, with fourteen 8-inch Pipes, 18 ft. long, with Bye-Pass, Valves, and Connections.
Twenty RETORT MOUTHPIECES, with Lids and Duplicates, Dip, Ascension, and Bridge Pipes, Hydraulic Main and Valve, Fire-Doors, Brickstaves and Tie-Rods.
12-inch and 8-inch MAINS, at per ton.
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For further Particulars and Prices, apply to H. I. WILLIAMS AND CO., Kidsgrove, STOKE-ON-TRENT.

GAS TAR and Ammoniacal Liquor Wanted.
Apply to JOSIAH HARDMAN, Milton, STAFFS.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating Price per ton and quantity, No. 2747, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Second-hand Gasholders, 50 feet and 60 feet diameter, with Iron Tanks preferred.
Address offers to No. 2738, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

URBAN DISTRICT COUNCIL OF OLDBURY.
(GAS DEPARTMENT.)

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Gas-Works, Dudley Road, Oldbury, for One, Three, or Five Years, as they may decide, commencing Jan. 1, 1897.
Coal carbonized, 8000 Tons Yearly.
Tenders, sealed and endorsed "Tender for Tar" and "Tender for Ammoniacal Liquor," addressed to the Chairman of the Gas Committee, must be delivered to the undersigned not later than Tuesday, the 24th inst.
The Gas Committee do not bind themselves to accept the highest or any tender.

By order,
A. COOKE,
General Manager.

Gas-Works, Oldbury,
Nov. 14, 1896.

SHEFFIELD UNITED GASLIGHT COMPANY.

PURIFIERS.

TO ENGINEERS, IRONFOUNDERS, &c.

THE Directors of this Company invite TENDERS for the supply and erection of Six PURIFIERS, 74 feet by 40 feet, together with internal Fittings, Covers, and Connections complete for the Purifying-House at their Grimesthorpe Station.
Drawings and Specification may be seen, and Bill of Quantities with Form of Tender obtained, on or after the 19th inst., on application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d., which will be returned on receipt of a *bonâ-fide* tender.
Sealed tenders, endorsed "Tender for Purifiers," to be delivered by post to the undersigned at the Company's Offices not later than the first post on Saturday, the 5th day of December.
The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Nov. 14, 1896.

HAWORTH URBAN DISTRICT COUNCIL.

TENDERS are invited for the purchase of the Council's surplus TAR and LIQUOR for the Year ending Dec. 31, 1897, delivered on Rails at Haworth Station.
Tenders to be sent to me not later than the 25th of November.

WILLIAM ROBERTSHAW,
Clerk.

Burlington Chambers, Keighley.

RAMSGATE CORPORATION.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for about 374 feet of Stourbridge or other approved quality FIRE-CLAY RETORTS, 23 in. by 16 in., 12,000 FIRE BRICKS, TILES, and 10 Tons of CLAY.
Tenders to be sent in on or before noon, on Monday, the 23rd of November, 1896, addressed to the Chairman of the Gas and Water Accounts Committee, Hardres Street, Ramsgate, endorsed "Tender for Fire-Clay Goods."
Specification and full Particulars on application to

WILLIAM A. VALON,
Engineer.

SECOND-HAND STATION METERS.

THE British Gaslight Company, Limited, have FOR SALE at their Etruria Works a STATION METER by Parkinson and Co. Capacity, 30,000 cubic feet per hour, with 12-inch Inlet, Outlet, and Bye-Pass Valves and Connections.
Also at their Tunstall Works, a STATION METER by Milne and Son. Capacity, 10,000 cubic feet per hour, with 8-inch Inlet, Outlet, and Bye-Pass Valves and Connections.
The Meters can be seen at work, and any further Information obtained, by application to the undersigned, to whom tenders must be sent not later than Nov. 28.

JOHN YOUNG,
Engineer.

Gas-Works, Etruria,
Stoke-on-Trent, Nov. 13, 1896.

THE Directors of the Sedbergh New Gas Company, Limited, invite SUBSCRIPTIONS for an issue of 4½ Per Cent. CUMULATIVE PREFERENCE SHARES, ranking for Dividend and Capital before the Ordinary Shares which are already subscribed. No Debentures are issued, or can be issued, without the consent of two-thirds of the Preference Shareholders.
Past Profits more than cover the amount required to pay Dividends upon the present issue. Improvements, Alterations, and Extensions are now being carried out, which will increase the value of the Security and enhance the Profits.
Full Particulars by applying to

W. ROBINSON,
Solicitor.

Sedbergh, Yorkshire.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.
He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
Offices: 18, FINSBURY CIRCUS, E.C.

SALE DEC. 8, 1896.

GUILDFORD GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS is instructed by the Directors to SELL BY AUCTION at the Mart, E.C., on Tuesday, Dec. 8, at Two o'clock precisely in lots, £5000 of ORDINARY STOCK in the Guildford Gaslight and Coke Company, ranking for a Standard Dividend of 5 per cent. per annum.
Particulars of the SECRETARY to the Company, at the Offices at GUILDFORD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, Tokenhouse Yard, E.C. on Tuesday, Nov. 24, at Two o'clock precisely, in Lots, the following high-class Investments:—
ALDERSHOT GAS AND WATER COMPANY (a new issue by order of the Directors)—200 £10 Five per cent. Preference Shares.
GRAYS GAS COMPANY, LIMITED—141 £10 fully-paid Shares.
WORTHING GASLIGHT AND COKE COMPANY (a new issue by order of the Directors)—200 £10 Shares.
CRAYS GAS COMPANY—96 £10 fully-paid Shares.
CRYSTAL PALACE DISTRICT GAS COMPANY—£2000 Five per cent. Stock.
HARROW AND STANMORE GAS COMPANY—110 £10 Shares.
KING'S LYNN GAS COMPANY—£550 Original Stock.
CROYDON COMMERCIAL GAS COMPANY—£75 "B" Stock.
Particulars of the AUCTIONEER, 18, Finsbury Circus, LONDON, E.C.

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Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

EAST LONDON WATER-WORKS COMPANY.

ISSUE OF £165,000 THREE PER CENT. DEBENTURE STOCK.
MINIMUM PRICE, PAR.

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the above ISSUE (being the third portion of the £500,000 Debenture Stock, created under the East London Water-Works Company's Act of 1894), bearing Interest at 3 per cent. per annum, less Income-Tax, and redeemable after the expiration of 25 Years from the date of issue, subject to six months' notice being given by the Company.
Minimum Price, Par.
Tenders must be delivered at the Company's Offices, St. Helen's Place, Bishopsgate, E.C., not later than Eleven a.m., on Thursday, the 10th day of December ensuing.
Particulars and Conditions, together with Form of Tender, may be obtained at the said Offices, or will be forwarded on application.

By order of the Court of Directors,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place, Bishopsgate, E.C.,
Nov. 5, 1896.

Now Ready, Price 15s., Limp Cloth, the Sixteenth Yearly

ANALYSIS OF THE ACCOUNTS

OF THE

Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to Gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the Year ended December 31, 1895, or March 31, 1896, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the Year ended December 31, 1895.

Compiled and arranged by

ALFRED LASS, F.C.A.

LONDON:
WALTER KING, 11, Bolt Court, Fleet Street, E.C.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
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W. RICHARDSON, Fitter.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED

— *v* —

"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

— *v.* —

"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared VALID ON ALL POINTS after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a "PIONEER INVENTION."

SCOPE OF PATENT. The Patent HAS BEEN GIVEN A WIDE CONSTRUCTION; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), IS STILL AN INFRINGEMENT of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an INJUNCTION, WITH FULL COSTS, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given AGAINST the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the VALIDITY OF THE PLAINTIFFS' PATENT.

"SUNLIGHT" MANTLES. Last about 100 hours.

"WELSBACH" MANTLES. Last about 1000 hours.

"Sunlight" Mantles BURN DOUBLE THE GAS to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to REPLACE THEM BY THEIR OWN MANTLES.

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, IN ALL CASES, BE RIGOROUSLY ENFORCED.

INFRINGERS. The Incandescent Gas-Light Company WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT WHETHER

MAKERS,
WHOLESALE DEALERS,
RETAILERS,
or
USERS.

Users of the Company's Mantles upon Burners not sold by the Company ARE INFRINGERS.

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

FAITHFULL & OWEN,
11, Victoria Street,
Westminster.

Solicitors to the Incandescent Gas-Light Company, Limited.

April, 1896.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY, LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

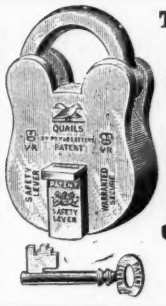
UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.



The Cheapest House in the Trade for
LEVER LOCKS
FOR
GAS-METERS.

Joseph Oakley & Co.
Excelsior Works,
WILLENHALL.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY
FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:
90, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . . 10,500 Cub. Ft.
Illuminating Power . . 16·9 Candles.
Coke (of good quality) . . 67·5 per Cent.
Sulphur . . . . . 0·58 „
Ash . . . . . 2·73 „

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

London Office: R. Cull, 31, Old Broad St., E.C.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,

165, QUEEN VICTORIA STREET, E.C.,

And at STROUD, GLOUCESTERSHIRE.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

For Prices and Particulars, apply to

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

THE "COOMBE" DRAUGHT SCREEN FOR INCANDESCENT BURNERS.

For Illustration and Statement of Advantages to be gained by its use, see "Journal," Nov. 3, p. 830.

ALFRED ARCULUS & CO., Glass Manufacturers,

BIRMINGHAM.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

Analysis—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Association, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON, Fitter.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

Coal Owners, Newcastle-on-Tyne

or

E. FOSTER & CO.,

12, John Street, Adelphi, London, W.C.

GOODSON'S

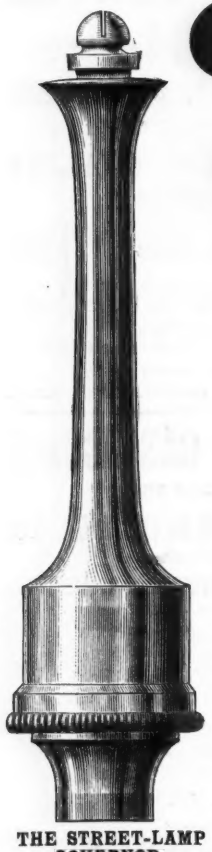
Patent Self-Acting

GAS GOVERNORS AND BURNERS.

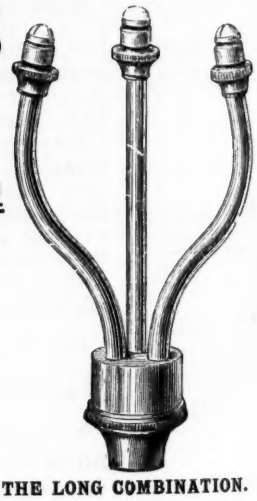
Approved of by the principal Corporations, Gas Companies, and Lamp Makers at Home and Abroad.

The Original Makers of SPECIAL GOVERNORS to suit the INCANDESCENT GAS-BURNERS, as adopted by The Incandescent Gas-Light Company.

12s. per Dozen.



THE STREET-LAMP GOVERNOR.



THE LONG COMBINATION.

THE "GLOSTER."

THE SHORT COMBINATION.

OTHER DESIGNS AND PRICE LIST WITH TRADE TERMS ON APPLICATION.

GOODSON & CO., 213, Vauxhall Bridge Road, LONDON, S.W.

OXIDE OF IRON.

NATURAL BOG ORE FROM OWN MINES.

Samples and Prices on application.

Wm. H. MÜLLER & CO.,

81, PALMERSTON BUILDINGS, LONDON, E.C.

TRADE MARK: "Compascum." Telegraphic Address: "FERRUM."

STOURBRIDGE

RETORTS AND FIRE-BRICKS.

BEST QUALITY.

KING BROTHERS, STOURBRIDGE.

[See Illustrated Advertisement, Nov. 3, p. 880.]

R. & A. MAIN,

GAS COOKING AND HEATING STOVES,

92, ALDERSGATE STREET, KINNING PARK,

LONDON, E.C., & GLASGOW.

D. HULETT & CO., LTD.

55 & 56, High Holborn, London.

GAS SERVICE CLEANSERS.

LAMP TORCHES.

DRY GAS-METER MAKERS.

WROUGHT-IRON TUBES & FITTINGS.

STREET LAMPS & POSTS.

PRICE LISTS ON APPLICATION.

TANKS ROOFS

CUTLERS PATENT TUBULAR GAS CONDENSER SUITABLE FOR GASWORKS OF ALL SIZES, AND FOR ANY CLIMATE OVER 100 ERECTED

MAKERS OF GASHOLDERS OF EVERY SIZE AND TYPE

HUNT'S PATENT WASHER. IS THE ONLY APPARATUS NECESSARY BETWEEN THE CONDENSER & PURIFIERS. IT REQUIRES NO MOTIVE POWER

TELEGRAMS "RETORTUS" LONDON

NATIONAL TELEPHONE 5059.

S. CUTLER & SONS, MILLWALL LONDON

FOREIGN AGENTS

A SPECIALTY

STEEL TANKS FOR GASHOLDERS AND OIL STORAGE.

ELECTRIC FITTINGS

IMPROVED SYSTEM OF CARBURETTED WATER-GAS PLANT PARTICULARS ON APPLICATION.

COLONIAL AGENTS

CUTLER'S FREEZING PREVENTER IS THE BEST APPLIANCE FOR PREVENTING FORMATION OF ICE IN GASHOLDER CUPS. IT IS IN USE AT MANY IMPORTANT WORKS IN ENGLAND, GERMANY, AUSTRIA, AND AMERICA

DYNAMOS MOTORS.

JOHN BROWN & CO., LTD., SHEFFIELD.

Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS, SHEFFIELD."

INCANDESCENT STREET LIGHTING, &c.

IMPORTANT TO GAS COMPANIES, LIGHTING AUTHORITIES, RAILWAY COMPANIES, &c,

Great Saving in Mantles, Chimneys, Attendance, &c.

ECONOMICAL, EFFICIENT, SATISFACTORY.

APPLICABLE TO EXISTING LAMPS.

MINIMUM OF SKILLED LABOUR REQUIRED IN FIXING.

Successful results guaranteed in all Situations.

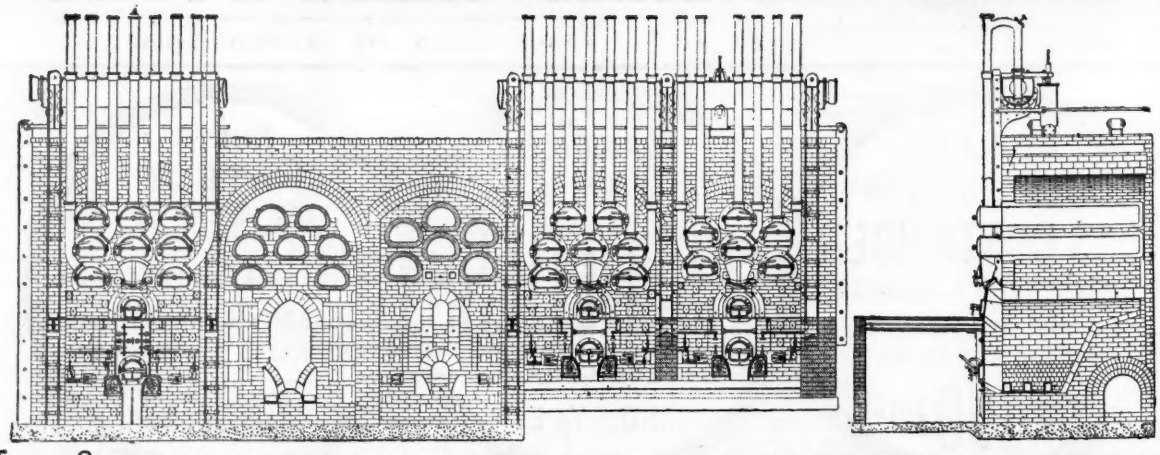
FULL PARTICULARS ON APPLICATION TO

THE ANTI-VIBRATION INCANDESCENT LIGHTING COMPANY, LIMITED,

12 & 14, WESTGATE ARCADE, BRADFORD, YORKS., ENGLAND.

Telegraphic Address: "CANDESCENT, BRADFORD."

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.

Further Information and Pamphlets from Principal Agent.

GAS COAL.

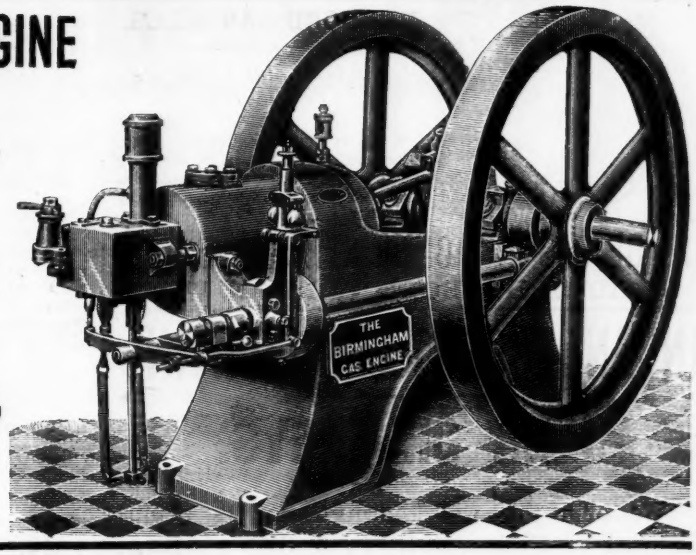
BEST
REAL OLD SILKSTONE GAS COAL,
Address THE STRAFFORD COLLIERIES COMPANY,
Near BARNSLEY, SOUTH YORKSHIRE.

THE BIRMINGHAM GAS-ENGINE

"OTTO" CYCLE.

A thoroughly reliable Engine for Commercial or Electric Lighting Purposes. Simple, Strong, Interchangeable.

Adopted by the Corporation of Birmingham Gas Department for Driving the Conveyors at their Swan Village Works.



WILLIAM GRICE & SONS,
Engineers and Founders,
FAZELEY STREET, BIRMINGHAM.
LONDON REPRESENTATIVE: Mr. SAM PUPLETT, M.I.M.E., 47, Albany Buildings, Victoria Street, Westminster.

LONDON OFFICE
60 QUEEN VICTORIA ST. E.C.

TELEGRAPHIC ADDRESSES
"DRAKESON HALIFAX."
"ECLAIRAGE LONDON."

TELEPHONE No 43.
"HALIFAX EXCHANGE"

GAS ENGINEERS.
CONTRACTORS.
IRONFOUNDERS.

JONAS DRAKE & SON

SOLE AGENTS FOR
HISLOP'S
PATENT REGENERATIVE FURNACES
— FOR —
ENGLAND, WALES & ABROAD.
RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES.
RESULTS GUARANTEED.

OVENDEN HALIFAX

RETORT SETTERS.
FURNACE BUILDERS.
ETC. ETC.

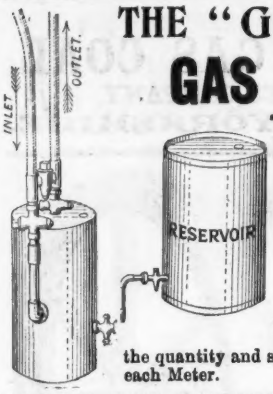
Designs and Estimates on Application.

GASEOUS FIRING A SPECIALTY.

MOBBERLEY & PERRY
STOURBRIDGE.

Manufacture & supply best quality of
Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)
Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.
FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c, &c.
EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.
Contractors for the erection of Retort-Benches complete.

London Agents:
BALE & HARDY, Gas Engineers and Contractors,
BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.



THE "GLOBE" PATENT
GAS ENRICHER.

IMPROVED LIGHT AND REDUCED GAS BILLS.

ESTIMATES AND TERMS ON APPLICATION.

When writing for Estimates, please state number of Meters in use, with the diameter of the Outlet-Pipe. Also the quantity and sizes of the ordinary Burners served by each Meter.

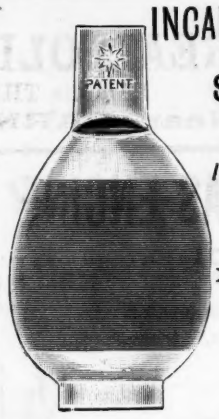
GLOBE GAS ENRICHER SYNDICATE, Ltd.,
81, HIGH HOLBORN, LONDON, W.C.

INCANDESCENT GAS LIGHTING
JENA CHIMNEYS.

We offer the well-known Chimneys manufactured by **Messrs. SCHOTT & GEN:, JENA,** at **56/6 per gross,** in original cases containing 3¾ gross.

Delivered free to any Railway Station in England. *Terms Cash.*

H. E. STENT & CO.,
10, North John Street,
LIVERPOOL.



INCANDESCENT GAS LIGHTING
SMOKELESS GLOBE-CHIMNEY.

CONSUMES ITS OWN SMOKE, AND INCREASES THE LIFE OF MANTLES.

No Chimney Required.

Prices 2s. 6d. to 4s. Od.
List on Application.

J. ORMEROD,
81, HIGH HOLBORN, LONDON, W.C.

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.

Established 1860.

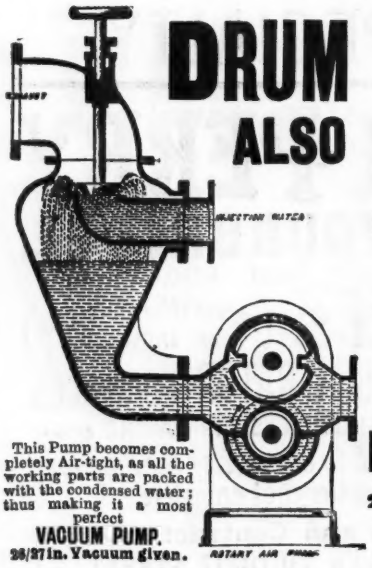
THE THAMES BANK IRON CO.
UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS,
AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of **LYON'S "PATENT" GAS-MAIN SYPHONS.**
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

JAMES MILNE & SON, Ltd.,
GAS ENGINEERS,
MILTON HOUSE WORKS, EDINBURGH.
LONDON. — GLASGOW. — LEEDS.

"The Force of the Piston Pump with the Capacity of the Centrifugal combined."

JOHNSON'S PATENT

DRUM PUMP AND EXHAUSTER
ALSO VACUUM PUMP AND CONDENSER.

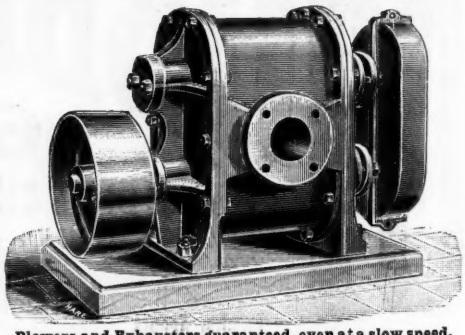


This Pump becomes completely Air-tight, as all the working parts are packed with the condensed water; thus making it a most perfect
VACUUM PUMP.
28/27 in. Vacuum given.

No Priming, Valves, or Frictional Working Parts.

The Pump of the future for quickly and economically moving large Bodies of Water, Semi-fluid, &c.

DRUM ENGINEERING Co.
27, CHARLES ST.,
BRADFORD.



Blowers and Exhausters guaranteed, even at a slow speed, to give a working pressure of 2 lbs. and upwards, and this without losing power by creating frictional Heat.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

MESSRS. HUMPHREYS & GLASGOW

Have constructed their EUROPEAN type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Brighton	1,500,000 Cub. Ft.
Belfast	1,700,000 ,,	Preston	1,500,000 ,,
Glasgow	300,000 ,,	Southport	750,000 ,,
Brussels	700,000 ,,	Bath	1,000,000 ,,
Liverpool	3,500,000 ,,	New York	1,200,000 ,,
Tottenham	750,000 ,,	Newburgh, N.Y.	350,000 ,,
Santiago	400,000 ,,	Tottenham (Second Contract)	750,000 ,,
Swansea	750,000 ,,	St. Joseph, Mo.	750,000 ,,
		Brussels (Second Contract)	700,000 ,,

And have now under Contract:—

Belfast (Second Contract)	4,500,000 Cub. Ft.	Stockport	500,000 Cub. Ft.
Shanghai	225,000 ,,	Norwich	1,000,000 ,,
Winchester	200,000 ,,	Guildford	350,000 ,,
Hoylake	125,000 ,,	Syracuse, N.Y.	850,000 ,,
Manchester	3,000,000 ,,	Bordentown, N.J.	125,000 ,,
Holyoke, Mass.	600,000 ,,	Lea Bridge	350,000 ,,
Edinburgh	2,000,000 ,,	Newburgh, N.Y. (Second Contract)	250,000 ,,
Stockton-on-Tees	500,000 ,,	Coventry	600,000 ,,

In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

9, Victoria Street, London, S.W.

Telegrams: "EPISTOLARY, LONDON."

United States Office, 64, Broadway, New York.

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

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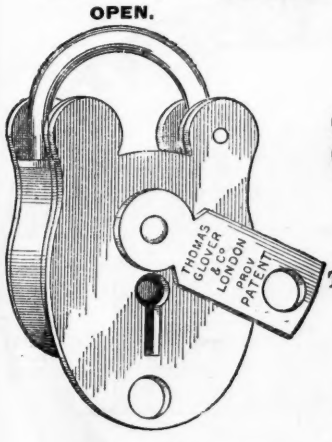
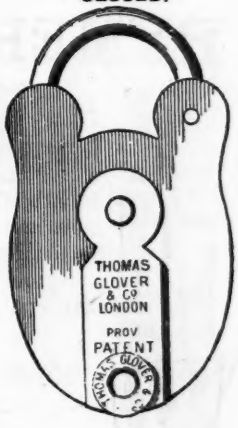


THOMAS GLOVER & CO.'S

PATENT

SECURE PADLOCK



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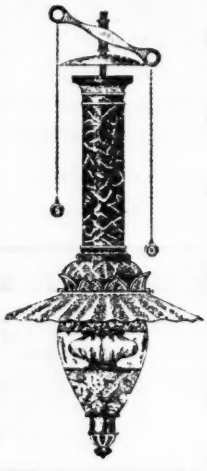

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LIGHT for LIGHT

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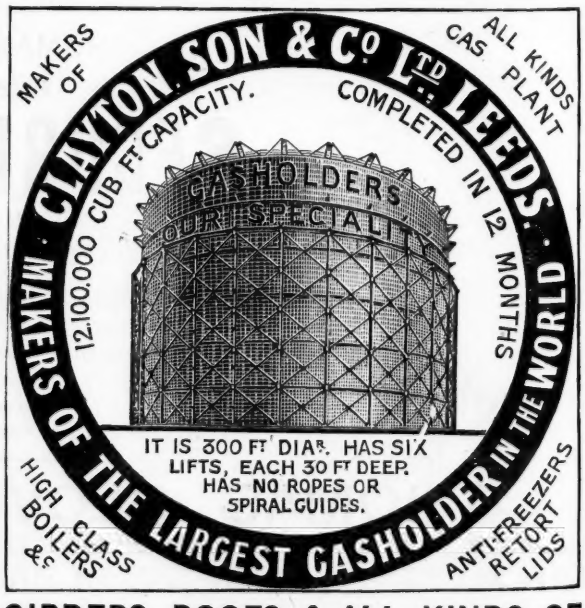
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IT IS 300 FT DIAS. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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CHARGING OR COAL MEASURING TRUCKS.

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Patent Automatic Machinery

FOR

DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

[See Illustrated Advertisement, Nov. 3, p. 831.]

PELOUZE & AUDOUIN'S

PATENT MECHANICAL CONDENSER.

Over 292,000,000 Cubic Feet of Gas per Day is passing through about 550 of these Machines.

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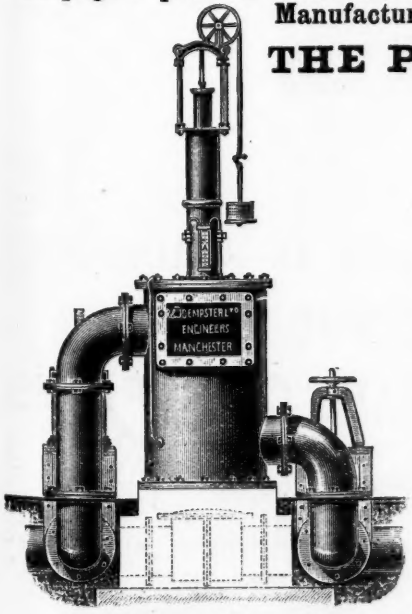
Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz, of Paris, to Manufacture and Sell in this Country and the Colonies,

THE PELOUZE & AUDOUIN CONDENSER,

According to P. AUDOUIN'S LATEST PATENTS.



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This Apparatus is in very general use in most of the Gas-Works on the Continent and in America; over **550** being in use in different parts of the World for condensing and arresting all Tar Particles and Vapours from the Gases from Coal, Oil, and Wood.

The large number in use is sufficient proof of its utility. By the almost complete elimination of Tar, which is effected to the extent of 99·7 per cent., it facilitates Purification in the Purifiers, by preventing the clogging or obstruction of the Purifying Materials, which, in consequence, last much longer; thus effecting a Saving both in Materials and Labour.

So effective is this Apparatus that a piece of white paper placed over a Test-Tap on the Inlet of the Machine is immediately covered with Tar, whilst on the Outlet the white paper remains perfectly clean.

The Machines are made in the following sizes, for Works producing per 24 hours—

	Cubic Feet.		Cubic Feet.
0	35,000	5	500,000
1	70,000	6	700,000
2	140,000	7	1,240,000
3	210,000	8	1,750,000
4	350,000	For larger Makes, two Machines are recommended.	

For Prices and further Particulars, apply to the Sole Makers—

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ALL OUR GAS-FIRES ARE FITTED WITH OUR

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No Fires hitherto made have more **effectually overcome the difficulty** of "**Lighting-Back**" and "**Hissing.**" When bringing out our Gas-Fires, we made a special study of these points; and our **Patent Circulating Burner** has proved **eminently successful in every particular.**

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[See also Advt. p. 950.

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